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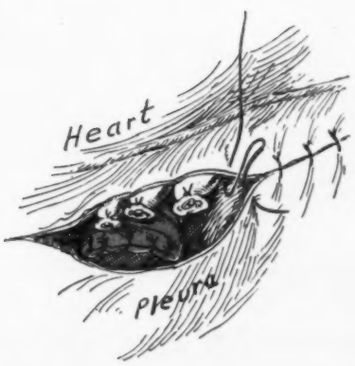

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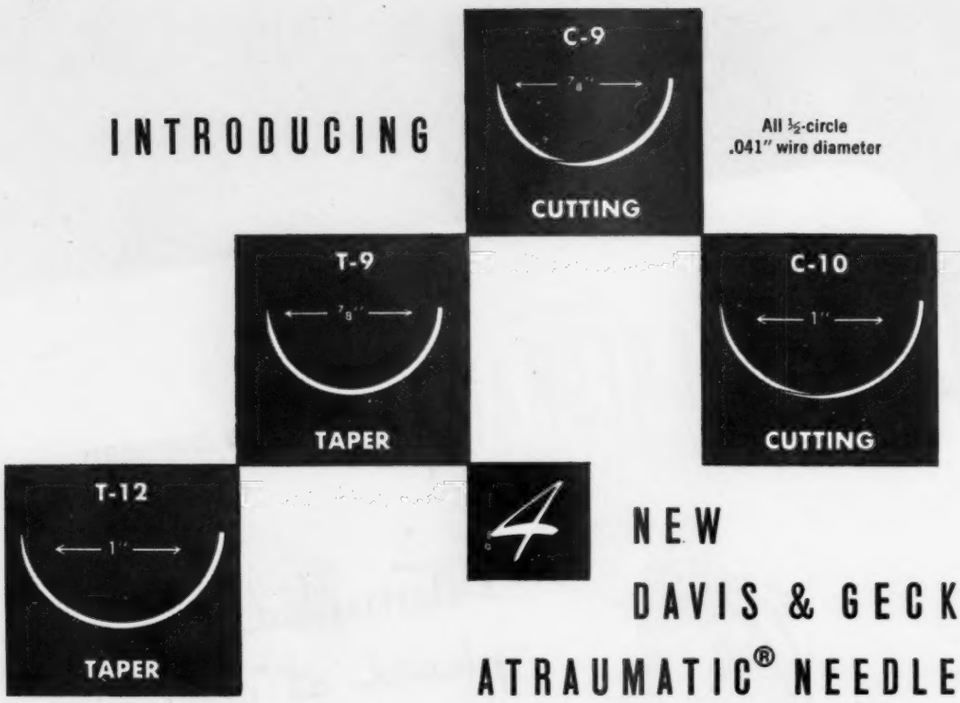

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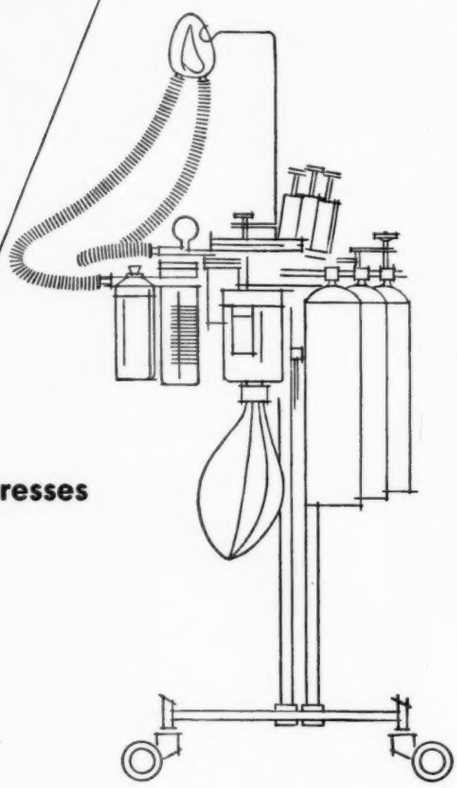

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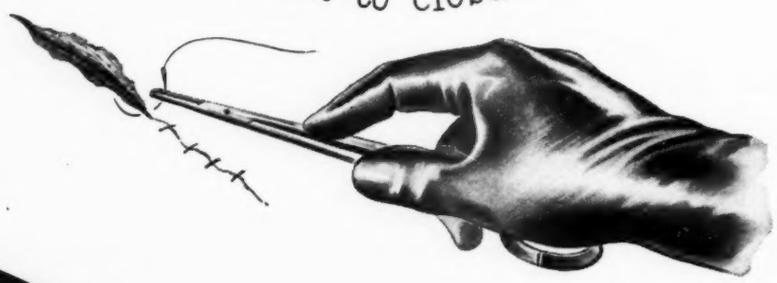

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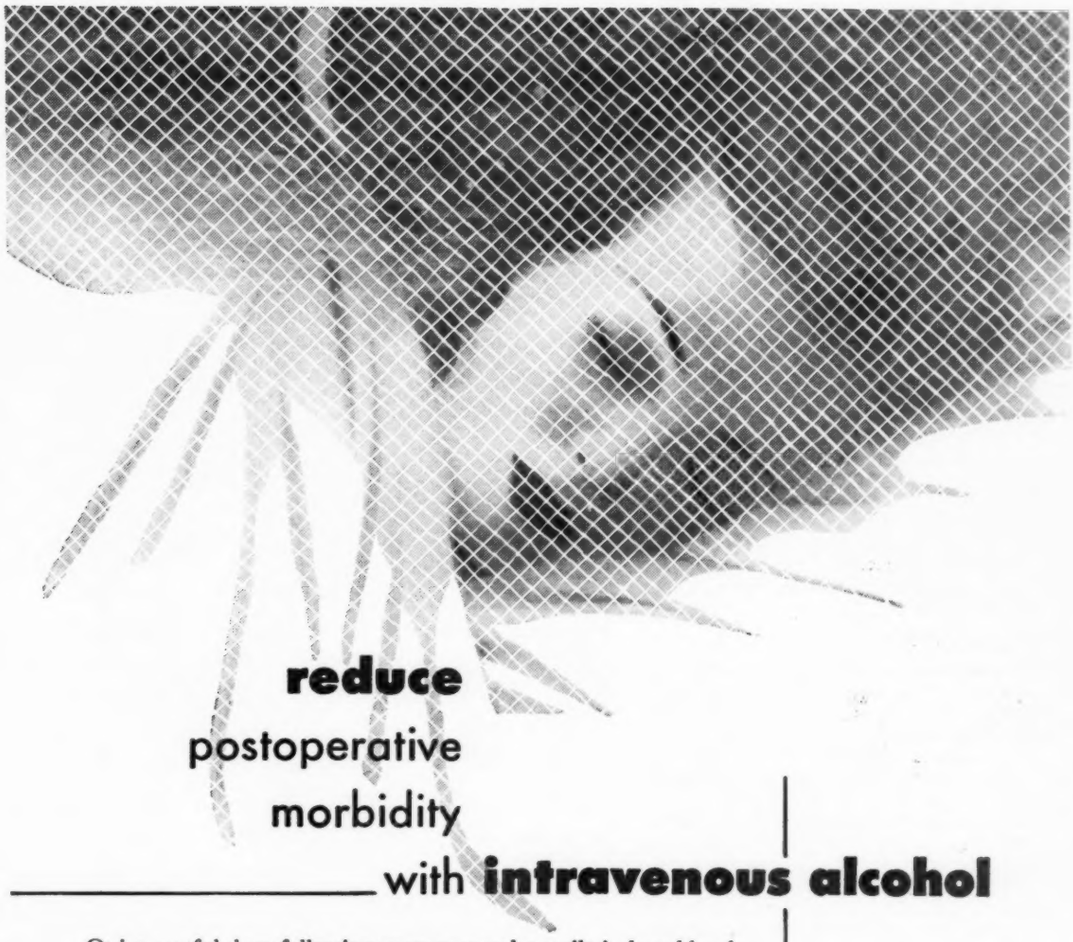

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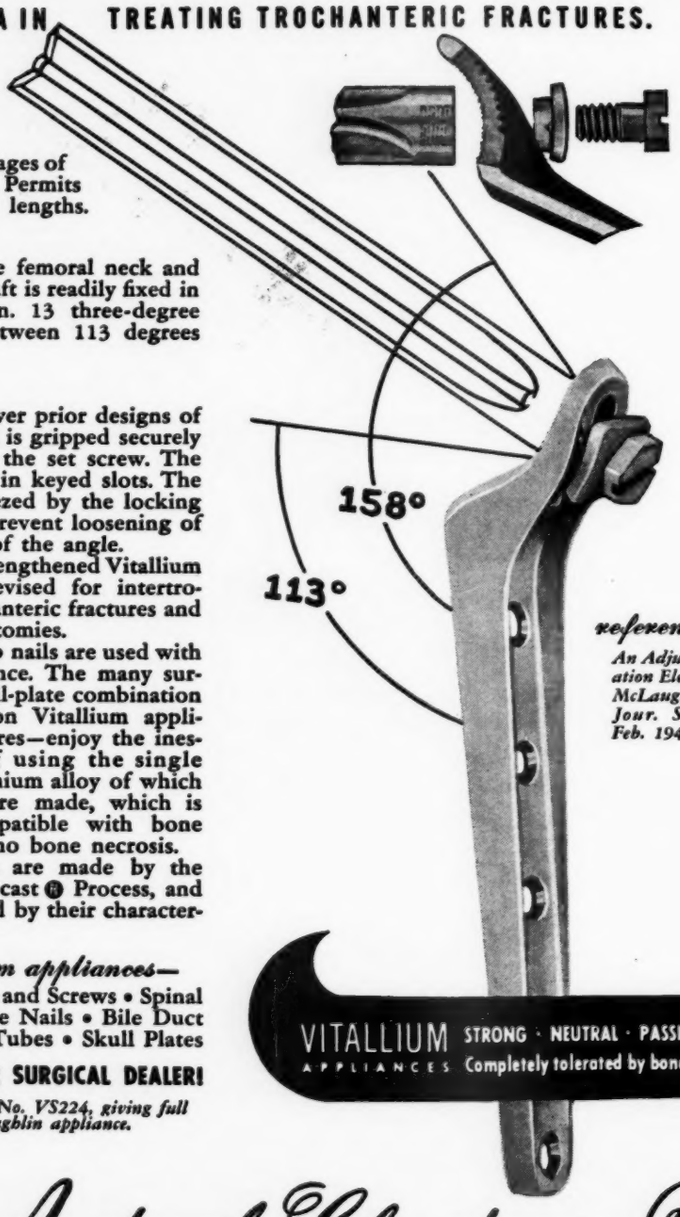

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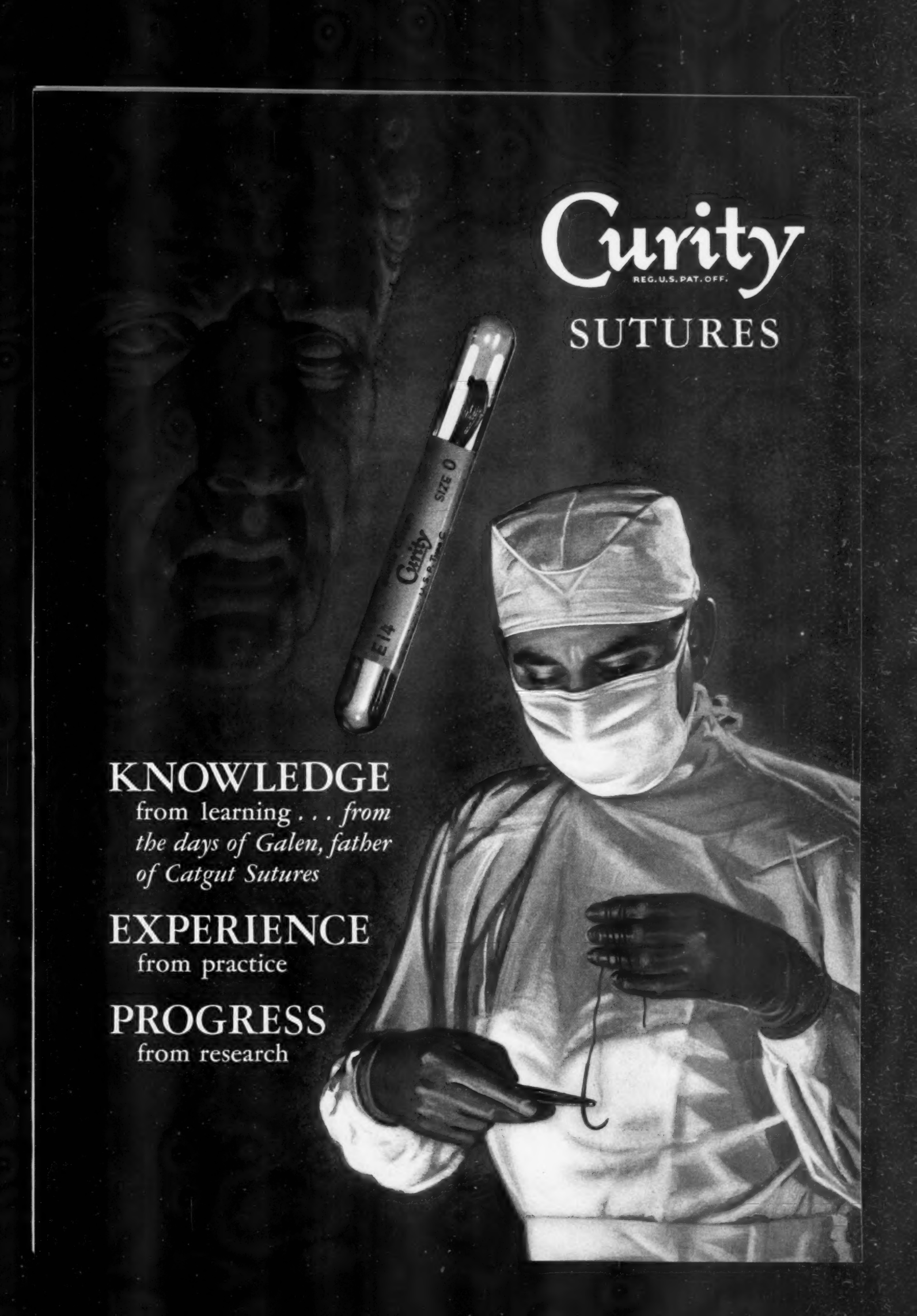
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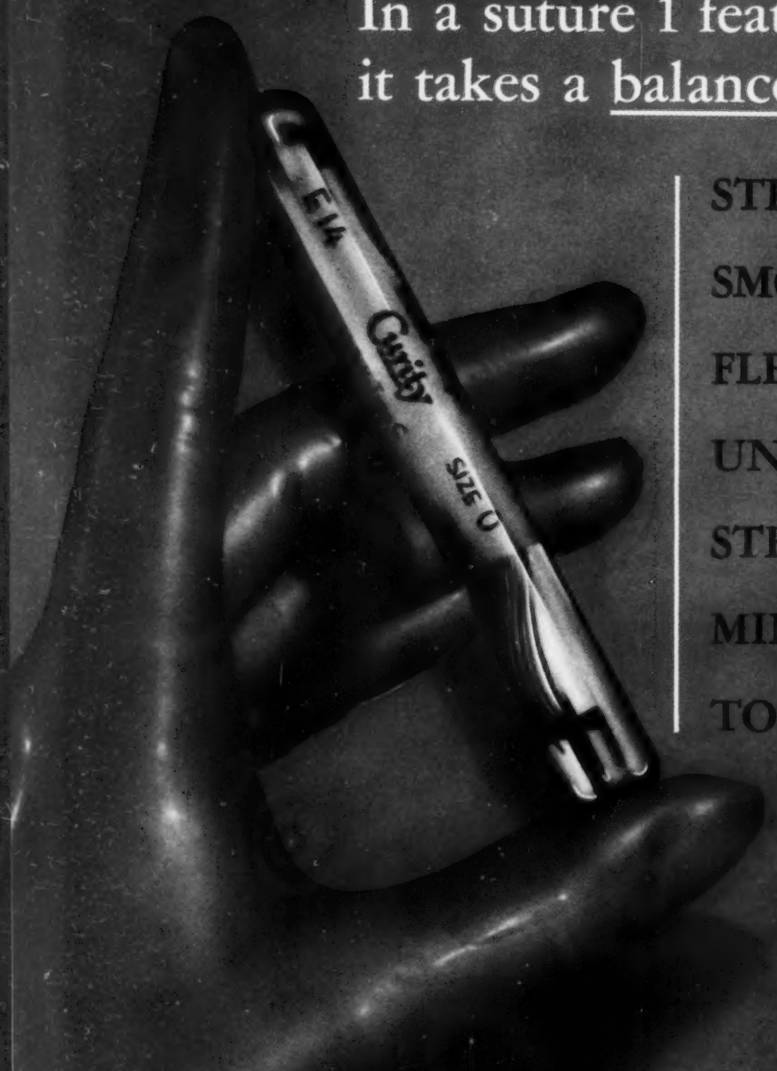

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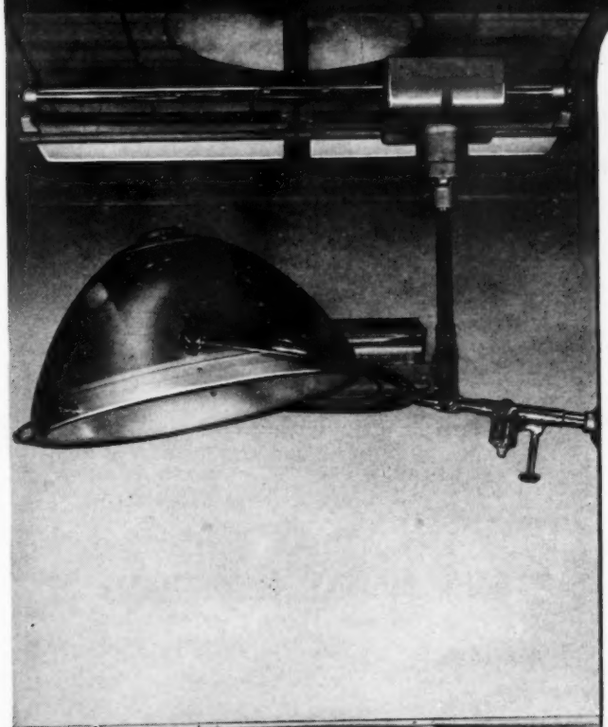

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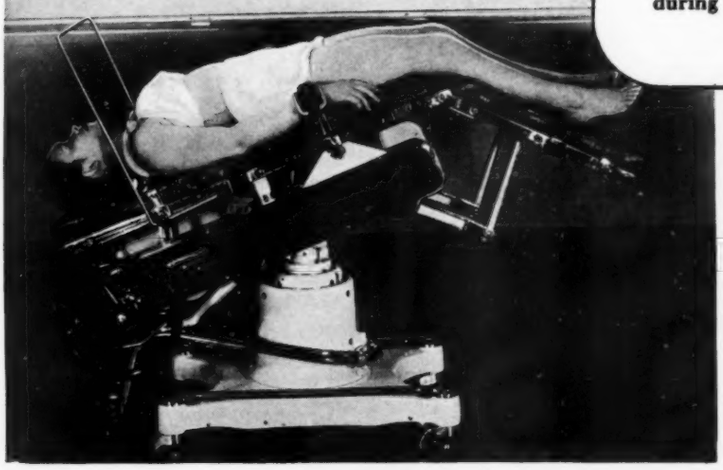

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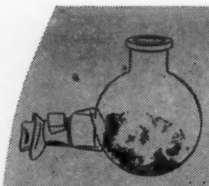

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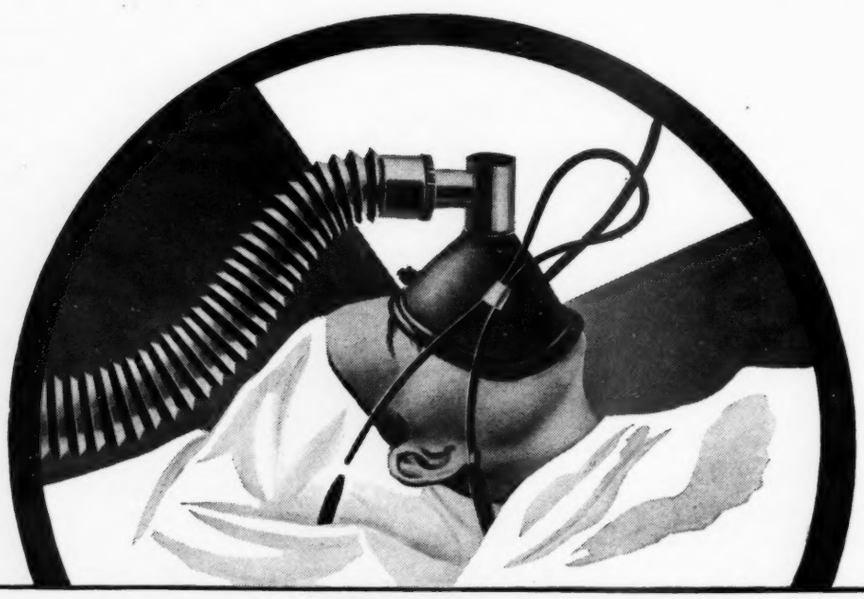

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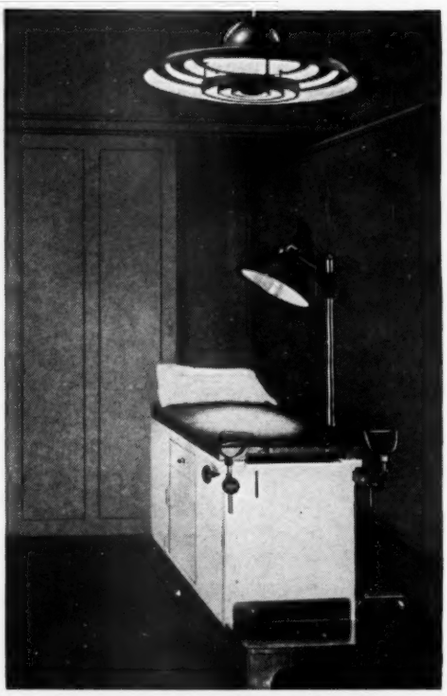

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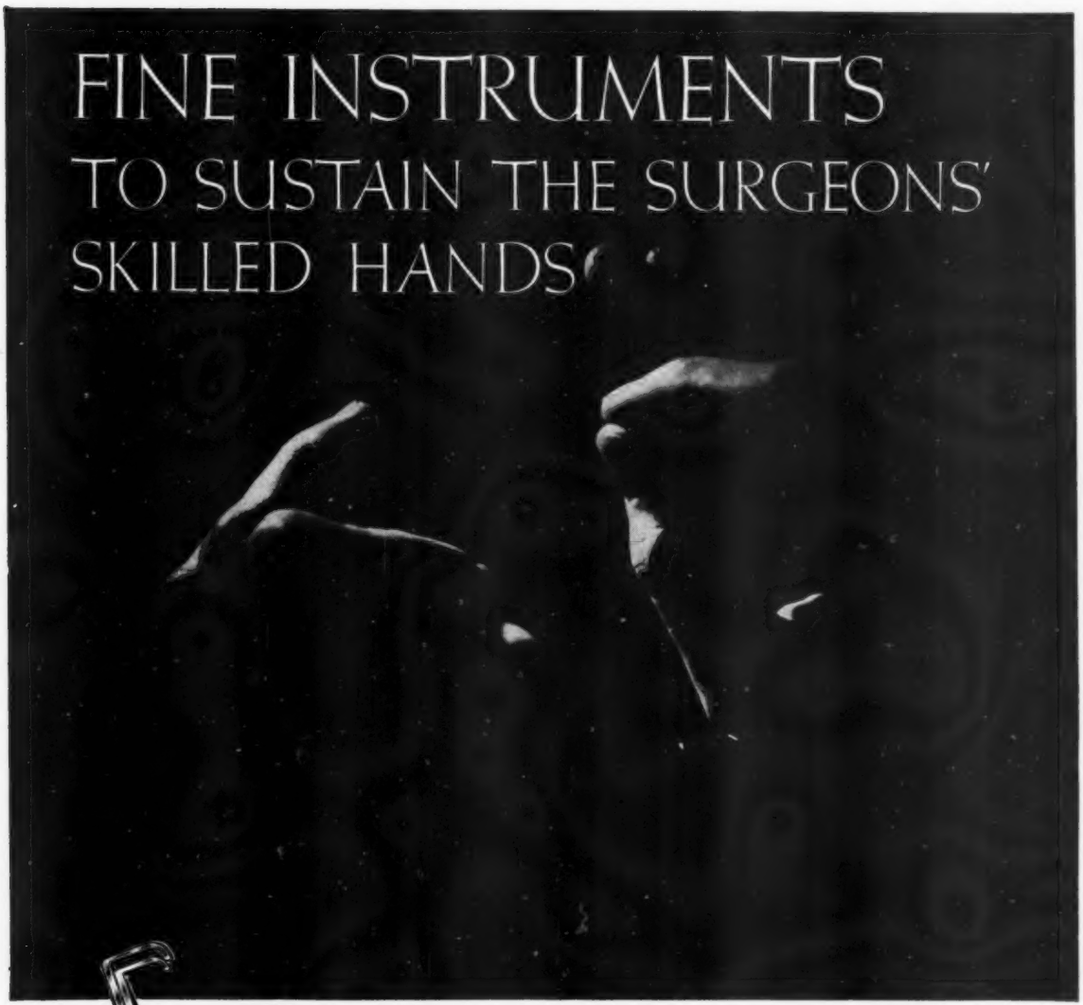

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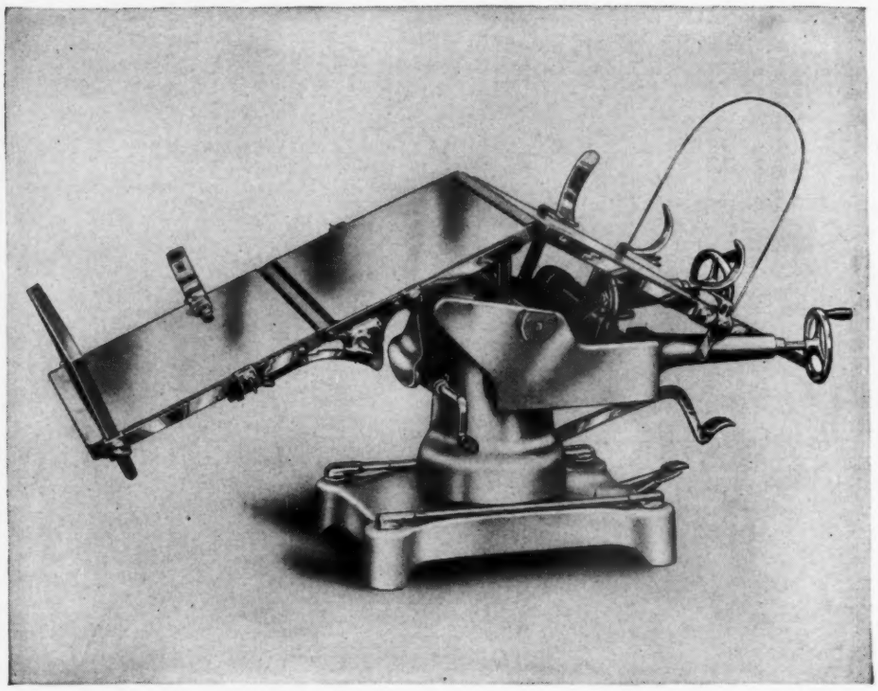

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new adhesive formula

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Outside the Ivory Tower

DR. RICHARD H. CORALES, JR., of New Orleans, Louisiana, assistant resident in neurosurgery at the Duke University School of Medicine, has been awarded a Damon Runyon Clinical Research Fellowship, the American Cancer Society has announced. The award for one year from July, 1949, to July, 1950, was made on recommendation of the Committee on Growth of the National Research Council. Dr. Corales will participate in a Duke research program in the field of brain tumors approved by the National Research Council under the direction of Dr. Barnes Woodhall and Dr. Guy Odom, professor and assistant professor of neurosurgery. Two other post-doctorate fellowships for Duke neurosurgeons have been awarded from the Atomic Energy Commission to Dr. Frank Wrenn of Anderson, South Carolina, and from the National Institute of Health to Dr. Courtland Davis, of Alexandria, Virginia. Drs. Wrenn and Davis will conduct studies in cooperation with the Duke department of biochemistry and division of neurology.

WE have gone through six new works brought out by The Williams & Wilkins Company. Right in the beginning we hasten to say that all of them are good. Due to lack of space and the fact we wish to bring them to your attention in this issue of the Journal we must merely offer you thumbnail sketches. The first is "Illustrations of Surgical Treatment" by Eric L. Farquharson, M.D., with a Foreword by the late Sir John Fraser, Bt. This is a third edition. The author has illustrated by numerous photographs practical methods of surgical treatment which are rarely covered in textbooks of general surgery. This book contains 391 pages, is indexed and has a wealth of excellent illustrations, photographs, line drawings and halftones. $7.00.

"Companion in Surgical Studies" by Ian Aird, CH.M., F.R.C.S., has 1,060 pages, including an index and bibliography. It is intended primarily for the trainee in general surgery and for the apprentice in a more restricted specialty who wishes to obtain a contemporary view of general surgery and of surgical specialities rather than his own. The author omits orthopedics and fractures. $15.00.

"A Short Practice of Surgery" by Hamilton Bailey and R. J. McNeill Love is an eighth edition. Any scientific tome that lives and is published as an eighth edition needs no review. If you desire a book of this type, you will never gamble when you select a work that has gone through many editions. It has 1,050 pages, an index and 1,198 illustrations. $10.00.

"Cystoscopy and Urography" by James B. Macalpine is a third edition, revised and enlarged, with 338 illustrations in the text and thirteen colored plates, 554 pages and an index. For those wishing a work on this subject we recommend this text. $13.50.

EVERY so often a publisher brings out a volume or a set of two or more volumes that almost takes one's breath away. The work involved and the outlay of money necessary to give the work birth are prodigious. Two such volumes, 663 pages with from four to eight illustrations to a page, and in addition a more than full index, has been published by The C. V. Mosby Company. It is "Atlas of Roentgenographic Positions" by Vinta Merrill prepared while Educational Director of Picker X-ray Corporation. We can do no better than quote from the Preface in order to give one an idea of what this work covers! . . . The purpose of this work is to provide a practical reference book for x-ray technicians by: "(1) Describing many roentgenographic positions and procedures, the unusual or specialized positions not used as part of a routine examination and not ordinarily included in general textbooks, as well as the standard positions. (2) Presenting information pertaining to anatomy and physiology. (3) Presenting the definitions of the more usual terms used in roentgenography. (4) Providing a bibliography to facilitate further detailed study." We cannot see how anyone doing the technical side of x-ray can afford to miss possessing these two volumes. It should almost become their technical bible. Anyone from the beginning intern to the "head-of-the-department" would do well to read carefully and study every page. It is beautifully done, a typographical masterpiece and well worth the cost—$30.00.

(*continued on page* 38)

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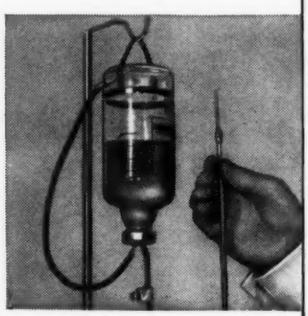

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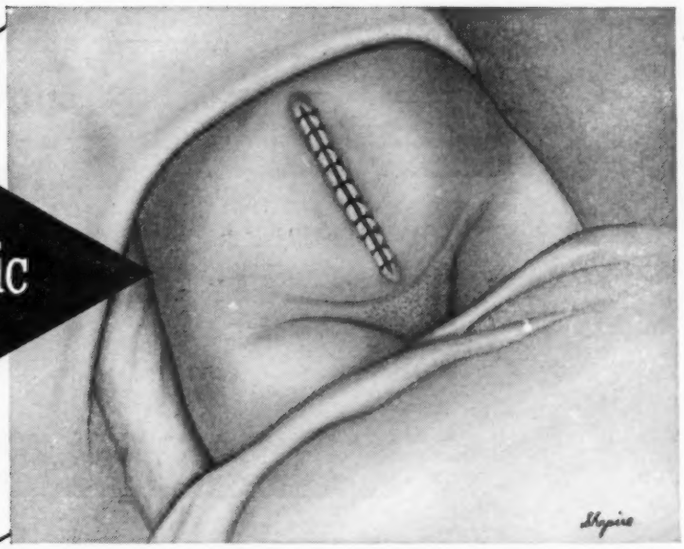

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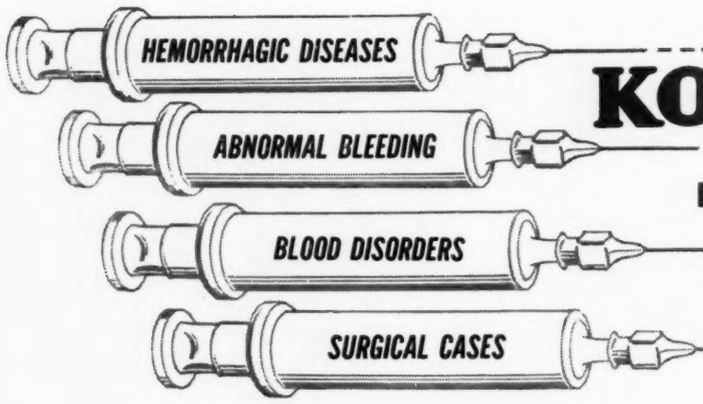

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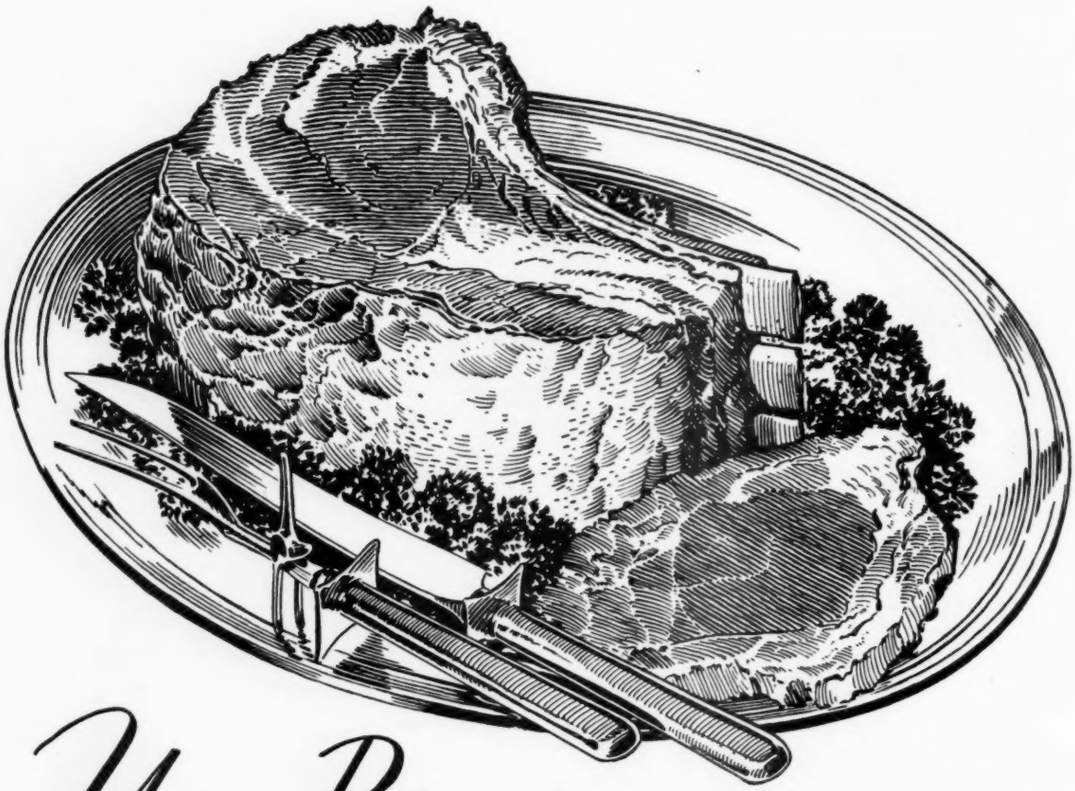
*Shipley, E. R. and Dodd, M. C.: Surg., Gynec. & Obst. 84:366, 1947. * McGivney, J.: South. M. J. 41:401, 1948.



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*McLester, J. S.: Protein Comes Into Its Own, J.A.M.A. *139*:897 (April 2) 1949.

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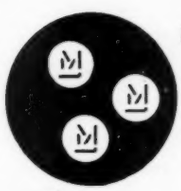

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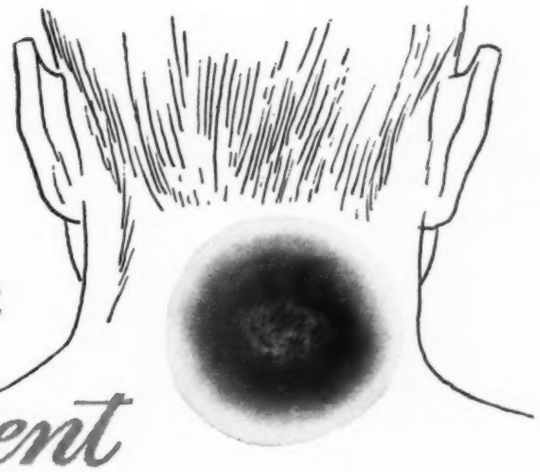

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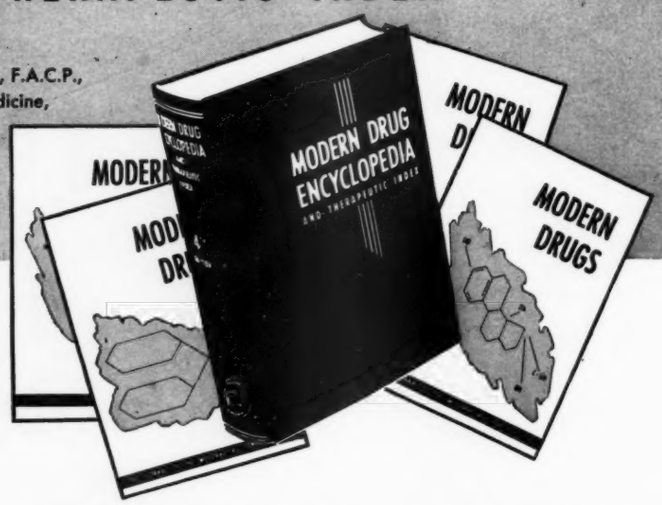

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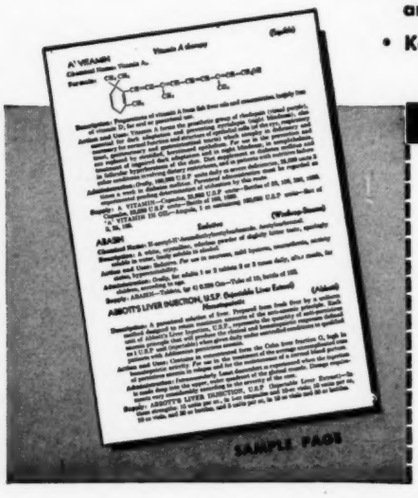

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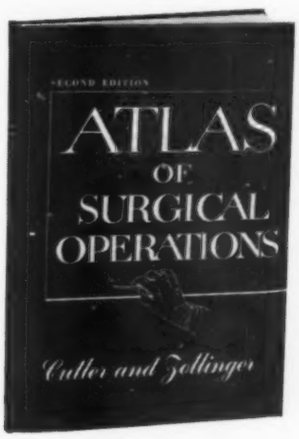

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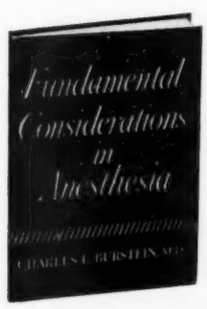
FUNDAMENTAL CONSIDERATIONS IN ANESTHESIA



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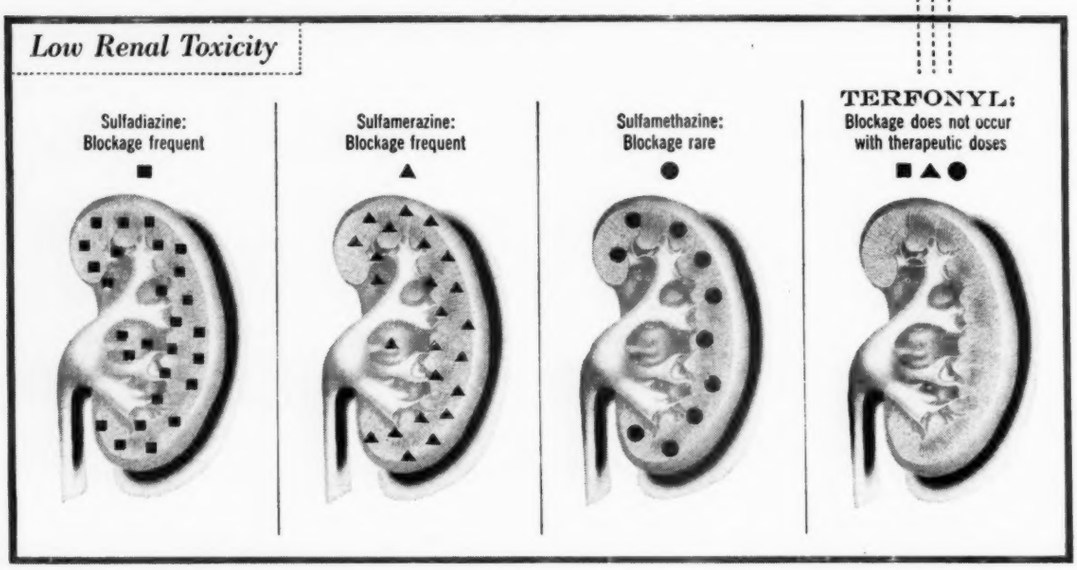

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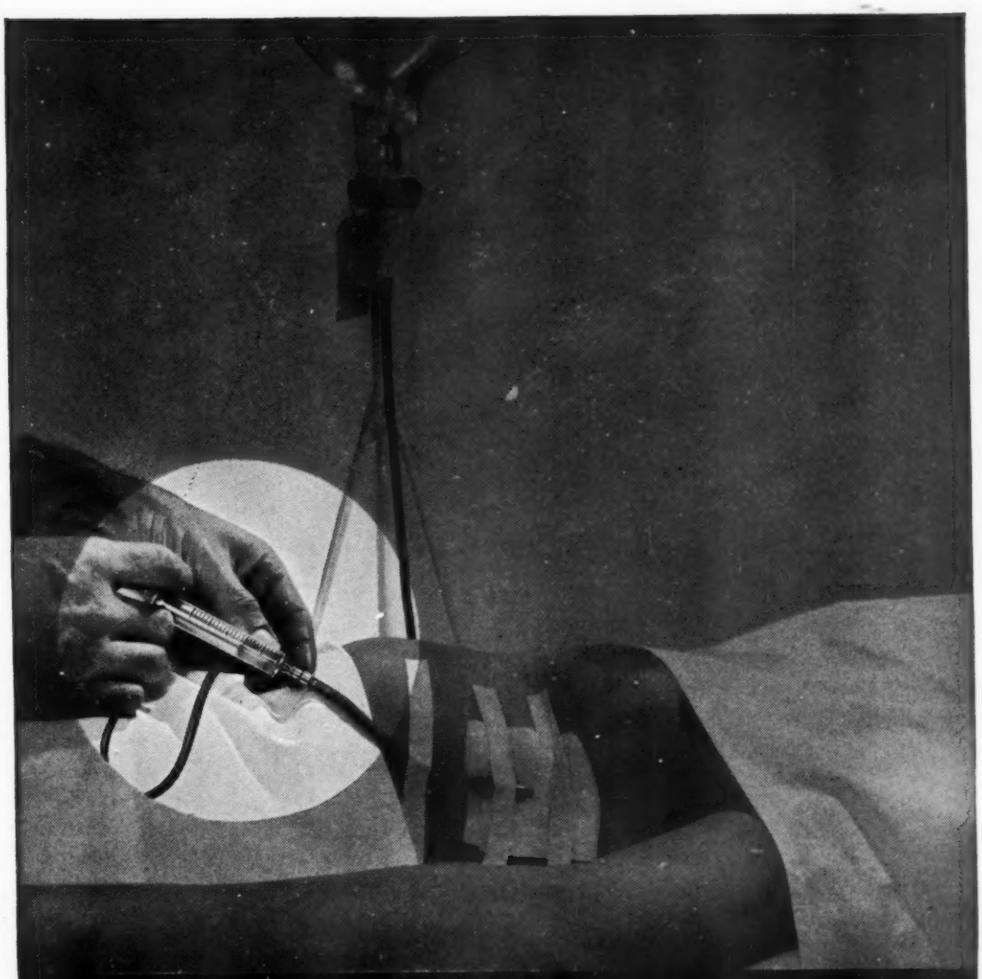

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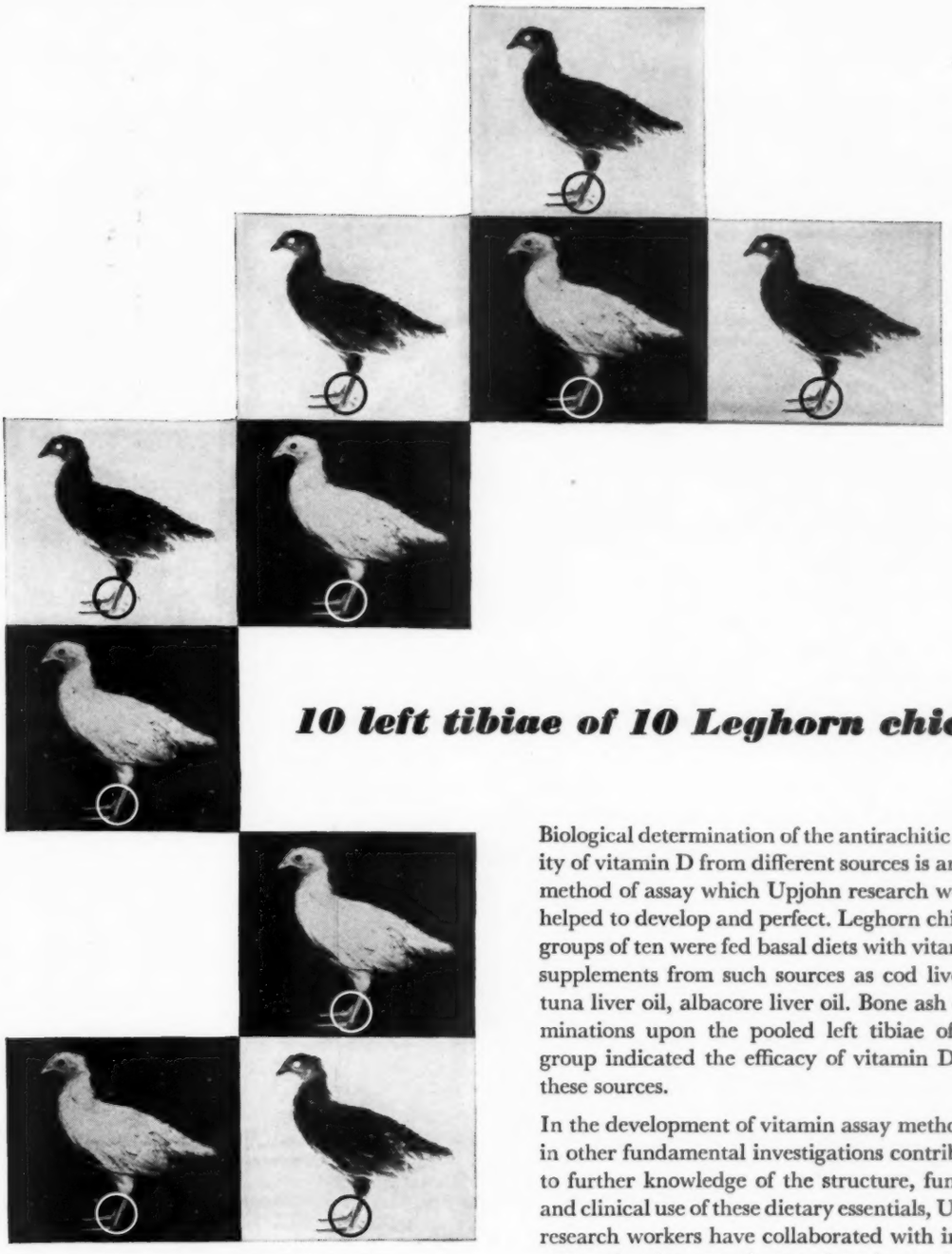

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Irvin Abell

1876-1949

A graduate of the Louisville Medical College in 1897, Dr. Abell studied in Berlin, Germany, in 1898, and practiced surgery in Louisville from 1900 to 1949. He received Honorary Degrees from six of the leading universities of the United States, was a member and served as President of many of the leading medical and surgical organizations of the United States. He was an Honorary Fellow of the Royal College of Surgeons of England and author of more than one hundred articles published in the medical literature.

During World War I, Dr. Abell was Commander of Base Hospital No. 59 and was Advisor in Medical Affairs to the United States Government during World War II.

A Fellow of the American College of Surgeons from its founding in 1913, Dr. Abell was President—1946-1947, and Chairman of the Board of Regents—1939-1949, and President and Chairman of the Board of Directors, The Franklin H. Martin Memorial Foundation—1946-1949.

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Editorial

PROGRESS OF THE RED CROSS NATIONAL BLOOD PROGRAM

ON the occasion of accepting the resignation of Basil O'Connor as President of the American National Red Cross President Truman in a complimentary vein observed that the National Blood Program, inaugurated during the O'Connor regime, may well become the greatest single health activity in history. That statement can be interpreted to mean that this newest humanitarian enterprise of the Red Cross is on the road to becoming an effective adjunct to the medical and surgical profession of the nation on a scale unenvisioned as yet by the populace at large. No other conclusion can be drawn from the record of accomplishment during the comparatively short period the program has been in operation.

In embarking on this far reaching project the Red Cross was able to utilize knowledge gained during the war period when the organization collected more than 13,000,000 pints of blood for distribution to the armed services. However, numerous operational problems not previously encountered had to be resolved during the planning stage of the peacetime undertaking. Obviously, under changed postwar conditions a series of loosely federated, local programs would be ill adapted to function as an efficient entity in time of serious disaster. The project was founded on a philosophy of cohesiveness and high standards, thus attracting the support of leading scientific groups and individuals.

With the endorsement of interested governmental agencies, the Division of Medical Sciences of the National Research Council, and a number of non-governmental agencies concerned with health, the first unit of the National Blood Program was instituted on January 12, 1948, by the activation of a blood-collecting and processing center at Rochester, New York, as the focal point for a regional program in eleven counties. Under the leadership of Dr. Ross T. McIntire, former Surgeon General of the Navy, expansion has been rapid. Including an all-mobile unit service in the State of Massachusetts there are now thirty regional programs in operation extending from coast to coast. These include two which were activated in September, 1949, with centers located at Savannah, Georgia, and Norfolk, Virginia, respectively.

In addition there are many local Red Cross blood donor programs such as the one in Greater New York. These local pro-

grams which exist in scores of cities are not at this time a part of the national Red Cross program but are helping to supply blood for local needs.

From January, 1948, through August, 1949, the total blood collections through the National Blood Program amounted to 344,213 pints. That large quantity was voluntarily donated by 288,883 separate persons. The blood was made available without charge to physicians and surgeons principally for use at 1,268 hospitals and some was distributed to seventy clinics. Mobile unit operations were carried on in 1,034 communities. Considering that one-half of the regional programs in existence at the end of August, 1949, had been in operation less than a year, a vigorous, accelerated growth is certainly in prospect.

The maintenance of complete records at the regional centers assures that the program, besides supplying the usual peacetime demand for blood in the communities served, can move quickly to meet the blood needs of a major emergency or national defense. The information regarding the blood group of each donor, his Rh factor, address and the answers to pertinent medical history questions are entered on a registration card. Moreover, several hundred chapters which have sponsored mobile unit visits possess blood group registers pertaining to the donors in the smaller communities. Whenever the call may come, the Red Cross will be in position to refer to the data on file and to know the total supply and location of the blood forthcoming.

Much of the success of the program to date can be attributed to its predominantly medical character. Guidance is furnished nationally by an advisory committee which is identical with the Committee on Blood and Blood Derivatives of the National Research Council of which Dr. Charles A. Janeway of the Harvard Medical School is chairman. The membership includes two distinguished surgeons, Dr. Isidor S. Ravdin of the University of Pennsylvania Medical School and Dr. Everett I. Evans, of the Medical College of Virginia. On the national headquarters staff in Washington, D.C. is Dr. Louis K. Diamond, Medical Director of the entire program. At each regional center the professional and technical responsibilities are similarly vested in a medical director. The chapter engages the services of a lay administrator who is in charge of the purely non-medical activities. Locally a medical advisory committee is responsible for professional guidance.

A further guarantee of sound operations is the official policy governing expansion of the national program. The Red Cross refrains from instituting a regional center or program unless requested to do so by the chapters concerned. The application from the chapters must be approved by the county medical society, local health department and local hospital association in each community under its jurisdiction.

Until now the major activity of the program has been to supply needed whole blood but in the future this will be only part of a broader program. During the fiscal year 1948 to 1949 the Red Cross issued for medical use considerable quantities of immune serum globulin, serum albumin, dried plasma and antihemophilic globulin. These products had been obtained mainly from stocks of surplus wartime plasma that were turned back to the Red Cross by the armed forces. The dried plasma and immune serum globulin were made available generally to the medical profession through state health departments and serum albumin and antihemophilic globulin to certain specialists engaged in clinical studies of these products. However, the supplies are now greatly reduced. Consequently, the resources of the national program will be directed toward their replenishment.

Plans have been formulated whereby plasma will be extracted from a certain proportion of the whole blood and sent to fractionation laboratories. Dried blood derivatives then will be sent in packaged form to the particular regional centers from which the plasma was received and will be

distributed to hospitals for specific therapeutic and surgical purposes. To date the demand for whole blood has been so heavy that fractionation has been possible only from small quantities of plasma. Materialization of this latest phase of the project, therefore, will be contingent on the ability of the chapters to recruit larger numbers of blood donors.

When large quantities of packaged blood derivatives can be distributed generally, a new epoch in scientific achievement will have been reached.

GEORGE W. HERVEY, SC.D.

Original Articles

SURGICAL CONSIDERATION IN THE MANAGEMENT OF CANCER OF THE COLON*

CLAUDE J. HUNT, M.D.
Kansas City, Missouri

ONE'S comment upon the surgical treatment of cancer of the colon must be related to his personal experience. With an adequate contact with this major problem all the complications and complex situations must have presented themselves several times. An analysis or review of each of these complications will materially formulate some positive conceptions relative to future management of similar situations.

Palliative colostomy, for example, is usually a procedure to be condemned. It gives no palliation and adds little to the patient's life but contributes much to his discomfort. It is uncontrollable and has contributed much to discredit colostomy performed in association with removable lesions. The pain and discomfort accompanying an unremoved, malignant lesion are attributed to the colostomy rather than to the progress of the disease.

A palliative colostomy is indicated only in advanced malignancy associated with impending obstruction. In many instances of such advanced states colostomy can be avoided by anastomosing around the lesion and preserving the fecal current; or, for the brief period of life remaining a diet without residue or liquid in character will obviate the annoying effects of a terminal colostomy.

Many patients who have large, fixed lesions or lesions involving adjacent intestines, abdominal wall, pelvic structures, bladder, prostate or posterior vaginal wall have too frequently been declared inoperable and a premature palliative colostomy has been done. We have in former years, because of inexperience and lack of courage, performed such an ill advised procedure and have subsequently learned that some more venturesome surgeon has successfully removed some of these lesions. Likewise, in recent years we have removed lesions on patients previously pronounced inoperable elsewhere upon whom a colostomy had been done. We now demand unmistakable evidence of inoperability before we resign ourselves to inaction. Ability, experience, courage and a willingness to accept defeat and an increased mortality rate are essential requirements for the adequate and proper management of these major problems. The successful removal of a seemingly inoperable lesion gives the surgeon a great feeling of satisfaction but the performance of a colostomy in a lesion of questionable operability is not consoling.

Palliative resection may add much to the patient's comfort and length of life and far exceeds in benefit a short circuit operation around the lesion or a colostomy. Pain and pressure from the growth of the lesion is lessened by palliative removal. Moderate metastases is no contraindication to resection and the removal of adjacent involved structures along with the lesion, when possible, is to be encouraged. Resection even in the presence of incurability is,

* From the Surgical Service at the Research Hospital, The Research Clinic and the Kansas City General Hospital, Kansas City, Mo.

therefore, strongly urged. The patients live longer and are more comfortable when the lesion is removed.

DIAGNOSIS

Any increase in resectability and five-year cure percentage can only be attained by early diagnosis and operation. A more general recognition of the fact that cancer of the colon and rectum are related to disorders of bowel function will lead to earlier diagnosis and earlier surgery. These are related to the passage of bright red blood, to signs of progressive obstruction or to soft, dark, frequent stools associated with an unexplained advancing secondary anemia.

Seventy-five per cent of the lesions are in the left colon or rectum and, therefore, are accessible to digital or instrumental investigation or may be studied by x-ray procedures. Right colon lesions may sometimes be obscured by the opaque media, especially if the mesocolon is long and pendulous; the lesion is behind the opaque media and hidden from view. All unexplained secondary anemias should suggest right colon malignancy and receive careful and often repeated radiographic study. Likewise, lesions of the splenic flexure may be obscured by the overlapping of the proximal limb over the distal when seen in the anteroposterior view. A lateral or oblique radiographic view will separate these structures and expose any bowel defect to inspection. Lesions may be missed by barium enema study unless these anatomic relationships are kept in mind.

Associated Lesions. A diagnosis of cancer of the colon does not mean that secondary cancer or polyps may not be present elsewhere in the colonic tract. Careful investigation by x-ray study should be made of the entire colon. If other lesions are found associated with the known cancer, operation may be extended to include a wide area of involved malignant or polypoid bowel. The mucosal pattern of the colon is not shown by a plain barium enema. Such a procedure simply shows caliber narrowing, irregularity of contour or obstruction. The opaque media must be partially expelled and air injected to contrast the protruding polyps and the surrounding mucosa. The polyps are seen as areas of different density surrounded by a thin layer of barium. On many occasions we have observed associated polyps by this procedure and have been able to extend the scope of resection and remove the polyps along with the cancer. We have observed lesions distal from the one under primary consideration and have subsequently removed them by secondary surgery.

Recently we operated upon two patients, both of whom within the year had a malignant lesion removed from the sigmoid. In one we removed a segment of involved abdominal wall, a secondary colonic cancer and some associated polyps adjacent to the primary operation. In the other, because of a slow, progressing obstruction and pain, we did a radical excision of the left colon, ovary and tube and many metastatic glands adherent to the iliac vessels. Both bowels showed polyps which we believe should have been found before primary surgery and removed along with the cancer. Both had been operated upon elsewhere by the obstructive resection type of procedure with inadequate bowel and mesentery removal. By this procedure of preoperative investigation and wide removal of the bowel and all mesentery drained by the segment recurrences will be diminished and secondary surgery will be minimal.

Cancer Potentialities. The progress of cancer of the colon and the complications which develop from it are directly related to the segment of the bowel in which it is located. Lesions on the right side produce ulceration, infection and a pronounced anemia and on the left side bleeding or progressive obstruction. Right colon lesions rarely obstruct or require stage operations. Fever, increased leukocyte count and local evidence of a pericolic inflammation will usually subside with sulfonamides, bowel evacuation and putting the bowel at rest by the Miller-Abbott tube. Lesions on the left side grow out into the bowel as an

adenoma or polyp and bleed and obstruct as they increase in size; or they infiltrate the intermuscular lymphatics and produce an annular or canalizing obstructing lesion. Lahey has emphasized the fact that these lesions do not produce the profound anemia often associated with cachexia so characteristic of right colon lesions. Were this so it could be said that they would be inoperable because of metastasis. Canalization represents an advanced infiltration of the lymphatics along the intermuscular spaces of the bowel.

OPERATION

Preparation. The essentials of blood, fluid, protein and vitamin restoration are recognized. Surgical approach is facilitated by a clean, unobstructed bowel and danger of peritonitis is enormously reduced by a week of administration of sulfasuxidine or sulfathaladine. Poth has demonstrated experimentally the value of these two inhibiting bactericidal drugs and he has found that healing of the anastomosis was by early formation of fibroblasts when sulfasuxidine had been given for a week preceding operation; whereas, without these drugs healing was by secondary intention with a noticeable absence of fibroblasts.

Streptomycin in my opinion is short lived, four to five days. It does for a time reduce colon bacteria but it is not sustained. It is most valuable when sulfonamides are precluded because of obstruction.

Surgical Approach. The problem of surgical approach is controversial. A friendly rivalry exists between those who advocate a stage obstructive type of resection and those who insist upon resection and primary anastomosis, a one-stage procedure. There must of necessity be a middle-of-the-road approach to the problem. Many patients thought to be suitable for a one-stage procedure are found at operation to be unsuitable for such an approach because of a variable degree of chronic obstruction, fixation, penetration or surrounding inflammation. A stage approach to the problem becomes obvious. Proximal decompression or a first stage anastomosis around the lesion to divert the fecal current as an ileocolostomy for a right colon lesion or a transverse colosigmoidostomy for a splenic lesion may be done.

One-stage Operations. Conditions for resection and primary anastomosis are very exacting and the procedure meticulous. There must be no obstruction, the bowel must be thoroughly clean, there must be no tension of approximated segments of bowel and the blood supply must not be compromised.

In the absence of obstruction, inflammation or fixation, primary resection and anastomosis can be done in any segment of the colon with a very low mortality.

We are not interested in the closed method of anastomosis. We are sure under ideal conditions, which can be obtained in unobstructed colon lesions, open operation adds little risk of peritonitis but affords accuracy of suture, minimum inversion of the bowel, controls hemostasis and affords inspection for adjacent polyps which in our experience are frequently observed. We have removed many which would have been missed by the closed method of anastomosis.

We believe peritonitis rarely results from an open anastomosis under appropriate conditions but is the result of continued contamination by leakage or tissue necrosis.

Obstructive Resection (Stage Procedure). Mikulicz in 1903 gave the first report of a series of patients managed by exteriorization. This contributed a great deal to the surgical approach to cancer of the colon. It became very widely employed and still is an approach preferable for the occasional operator. Many objections soon became apparent, objections relating to implants in the abdominal wall and inadequate removal of the gland-bearing mesentery. This was largely overcome by the standardized procedure of wide obstructive resection advocated by Rankin and Lahey. We are certain that in limited regions of the left colon as wide an area of mesentery and as extensive a segment of bowel can be

removed by this method as by primary resection and anastomosis. Occasionally, due to some degree of proximal edema or an inadequately clean proximal bowel primary anastomosis must be abandoned and the obstructive type of resection substituted. A direct answer to the merits of primary anastomosis versus obstructive resection from the point of view of operative mortality in large groups of cases is unquestionably in favor of the latter. We have seen no report whose results by the one-stage operation excels those obtained by Lahey, Jones, Rankin and Dixon with obstructive resection.

Obstruction. Obstruction must be abolished before resection of the lesion is attempted. This is best done by cecostomy or right transverse colon colostomy. We prefer cecostomy for all obstructions proximal to the sigmoid and transverse colon colostomy for those of the sigmoid and rectosigmoid. In the former we want free mobility of the transverse colon; in the latter the bowel can be better irrigated and cleaned through a right colostomy and its location in the right transverse colon will not restrict sigmoid or rectosigmoid resection and anastomosis.

Obstructive colon lesions form a closed loop type of obstruction and are comparable to strangulated small bowel obstruction. The blood supply to the bowel becomes impaired as distention progresses and gangrene and perforation may occur. The bowel distends to an enormous size. In a thin individual the contour can be seen outlining the course of the colon. The wall is paper thin and difficult to manipulate surgically. The most accessible site for decompression is usually the cecum as the transverse colon is pushed up under the liver by the enormously distended cecum. This we deflate by needle puncture and obstructively exteriorize a small segment of the cecum, close the abdomen around it and then insert through our cecostomy clamp a catheter into the bowel which serves as a vent for the escape of gas until the bowel adheres to the abdominal wall when the clamp can be removed and the bowel irrigated.

SEGMENTAL CONSIDERATION OF COLON MALIGNANCY

Right Colon. Right colon lesions deserve detailed consideration from the point of view of surgical removal. Segmental or partial removal has no part in surgery of the right colon. It is entirely inadequate and falls far short of removing all the gland-bearing tissue. The fan-like distribution of the mesentery of the right colon extends from the terminal ileum to beyond the hepatic flexure and spreads out across a portion of the duodenum and the inferior border of the pancreas to focus at the root of the superior mesentery vessels where the sentinel glands of this large, gland-bearing area drain into the portal and aortic system. Any resection short of removal of the entire gland-bearing structure is inadequate. Vascularity of the right colon is variable and viability of the transverse colon may be inadequate for a distance after ligation of the mid-colic artery. We lost one patient by necrosis of the closed stump of the transverse colon after right colectomy. Technical procedures are dependent upon the local condition of the lesion. Usually, primary resection can be performed. We prefer union of ileum to colon by an end-to-side anastomosis; it more nearly approaches the normal relationship of ileum to cecum. The side-to-side method is excellent; a wide opening can be made. No long, blind end of bowel should be left. We operated upon one enterocele of the ileum in the blind end of a side-to-side ileocolostomy. An end-to-end anastomosis is excellent but is difficult sometimes because of caliber differences. In either instance proximal enterostomy is no longer indicated. A Miller-Abbott tube is useful but with a good stoma obstruction from edema will not develop. Negative gastric suction is always used for a few days.

Hepatic obstructive lesions require preliminary ileocolostomy prior to resection

and fixed inflammatory lesions without obstruction may have complete diversion of the intestinal stream by transaction of the terminal ileum, closure of the distal end and an ileocolostomy.

Transverse Colon. Transverse colon lesions should be diagnosed early. Like the cecal and sigmoid lesions they are more accessible to palpation. Often they are non-obstructive and primary resection with anastomosis is feasible. We have always found it advisable to mobilize both the hepatic and splenic flexure to afford wide resection and approximation without tension. Cecostomy effectively relieves obstruction and in no way limits mobilization and resection.

We have used resection in several cases in which a segment of small bowel was involved by continuity with the neoplasm. Recently a large lesion had several fistulous tracts into a segment of jejunum. This mass of colon and small bowel was excised and appropriate anastomoses were made; recovery was uneventful. Two cases of cancer of the transverse colon so involved the stomach that partial resection of the stomach was necessary. Both patients survived and have lived more than three years.

Splenic Flexure. The symptoms of splenic flexure lesions are remote and are referred largely to the right side of the abdomen. The lesion is high, inaccessible and a variable degree of chronic obstruction or actual obstruction is present before the diagnosis is made. Delay has often resulted in fixation, penetration and abscess formation. In our experience it has been wise, usually, to do proximal surgical decompression by cecostomy prior to attempted resection. This we consider an excellent routine procedure as it affords a much needed vent for escape of gas following resection and anastomosis. It acts as a complementary decompression. We believe that with splenic flexure lesions the entire descending colon should be removed and the anastomosis made between the transverse colon and sigmoid. This affords a wide removal of gland-bearing tissue and affords anastomosis of segments that are freely movable and are largely covered by serosa. The descending colon is only partially peritonealized and is a poor structure for anastomosis. Many unknown, small polyps are frequently seen in a resected specimen of this extent.

Descending Colon and Sigmoid. The descending colon has an inadequate peritoneal covering, little or no mesentery and poor mobility. A wide removal of the entire descending colon, the splenic flexure and a segment of the upper sigmoid with anastomosis of the transverse colon to the sigmoid adequately removes a wide area of gland-bearing tissue and any associated polyps and approximates without tension segments of bowel more suitable for end-to-end anastomosis.

Sigmoidal lesions often present local conditions suggesting inoperability. Fixation to the ureter and iliac vessels may be extensive but protracted investigation often discovers a line of cleavage and makes extirpation possible. By exposing the ureter above the lesion and following downward it can be isolated and a plane entered which assists in freeing the lesion from important vascular structures.

Complications of fixation, metastases and extension require expanding the scope of surgery if resection is feasible. Three times a ureter has been excised along with the lesion without subsequent removal of the associated kidney. The entire left lobe of the liver was removed because of a protruding, pedunculated, metastatic mass in two instances during the abdominal phase of a Miles' resection. Small bowels were involved by continuity in several instances, both in sigmoid and transverse colon lesions, and mass resection with appropriate end-to-end anastomosis was done without incident. The transverse colon was involved by continuity from a sigmoid lesion and the entire segment of bowel was removed without technical difficulty or delayed recovery. We approach all malignant lesions of the colon and of the rectum with only one thought in mind, that of removal. If

this cannot be accomplished, the primary lesion is excised if anatomically possible and expedient.

Low Sigmoid. For lesions of the low sigmoid in which we were unable to do an obstructive type of resection and in which we at that time did not do a primary anastomosis for left colon lesions, we would often do a Hartmann type of operation rather than an abdominoperineal resection. I well recall how favorably these patients recovered and how many of them subsequently remained well for a long period of time. One patient in her fifteenth year following such an operation had no evidence of recurrence. Another, eight years after this procedure, remained well.

Dixon added much to the comfort of these patients through preservation of bowel continuity by his anterior type of anastomosis. We have had excellent success with this procedure and we believe that it is a splendid one in elderly individuals with short life expectancy and a movable lesion without apparent metastasis.

Rectosigmoid. Below the pelvic peritoneum difficulties are encountered in the procedure. The lower segment has no peritoneal investment. The tissues below the pelvic peritoneum are susceptible to infection and accuracy of suture due to inaccessibility is apparent. We believe this, however, to be a practical operation and one with a low mortality rate if performed under proper conditions and with meticulous technic. A wide resection can be done, the mesentery above can be removed and the bowel excised sufficiently far below the lesion to include retrograde extension, which is rare and usually not beyond 2 to 3 cm.

Too many lesions because of fixation or extension to bladder or female pelvic structure are thought to be inoperable and a colostomy is performed. We believe resection should be extended to the point of removal of a bladder segment, pelvic adnexa or hysterectomy. This we have done. In one instance a segment of the bladder was removed along with the lesion and several times adnexal tissue or uterus comprised part of the removed specimen.

Babcock, Bacon, Best, Waugh, Wangensteen and others are enthusiastically supporting the sphincter preservation operation for many lesions well below the pelvic peritoneum. Their reported results well support their contention of the desirability of maintaining bowel continuity and sphincter preservation. The procedure at present is controversial.

SUMMARY

1. Palliative colostomy is mentioned only to be condemned as a procedure adding little to life expectancy and much to discomfort. Many lesions that appear inoperable can, by more careful investigation, be removed or circumvented by iliocolostomy or colosigmoidostomy, thus preventing colostomy.

2. Mortality studies aid in future management as many errors can be prevented by a careful evaluation of previous experience.

3. Age is no barrier to the development of cancer and advanced age is no contraindication to surgery. Cases are cited.

4. Emphasis is placed on the early manifestations of cancer of the colon and methods of investigation are discussed.

5. The importance of detecting multiple or associated benign and malignant lesions is stressed and cases of such associated lesions are reviewed.

6. Preparation and surgical approach to the problems are discussed and the indications and merits of both primary and obstructive resections are presented.

7. The importance of proximal surgical decompression prior to resection of obstructing neoplasms of the colon is stressed.

8. The management and indications for certain procedures related to the various segments of the colon are specifically mentioned, and the clinical manifestations, potentialities for complications and manner of approach are presented.

9. Advancement in the surgical approach of lesions of the low sigmoid and rectosigmoid are described and the anterior type

of resection urged. Complementary colostomy is not to be condemned but rather advised as a safety measure.

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Pulsating exophthalmos occasionally occurs in patients with recent fractures involving the base of the skull. An aneurysm of the carotid sinus has resulted and produced the aforementioned clinical syndrome. If conservative measures are of no avail, one must resort to radical surgery. Usually ligation of the internal carotid artery in two stages is sufficient to produce a cure. At the first stage only a partial occlusion is effected by the heavy silk ligature; later the artery is completely closed and at this same sitting the internal jugular vein is also ligated. Should further surgery eventually prove necessary, one would have to resort to intracranial ligation of the internal carotid artery supplement by electrocoagulation of the ophthalmic arteries. (*Richard A. Leonardo, M.D.*)

AUREOMYCIN IN SOFT TISSUE INFECTIONS*

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AUREOMYCIN, an antibiotic substance introduced by Duggar and associates,[1] has an unusually wide range of antimicrobial activity. This has been proven by many laboratory[2–6] and clinical studies.[7–14]

The use of other antibiotics in surgical infections has been attended with certain difficulties. Meleney and his associates,[15] using bacitracin systemically, showed that it had a nephrotoxic factor. The studies of Pulaski and co-workers[16] with streptomycin proved that it was sometimes toxic in therapeutic doses. In view of these facts the relative lack of toxicity of aureomycin in therapeutic dosage was of especial interest. Its value seemed enhanced by the fact that it could be administered orally, intravenously or intramuscularly with effective results. Aureomycin was used in conjunction with surgery at Harlem Hospital in a series of cases of established peritonitis,[13] with excellent results. For these reasons it was decided to undertake a study of its value in surgical infections of the soft tissues.

The following is a report of our results obtained in eighty-two cases of such infections (Table I): Surgery was employed when indicated but aureomycin decreased the necessity for operative intervention.

CELLULITIS

Forty-two patients with cellulitis were treated with aureomycin. (Table II.) In approximately 50 per cent of these patients the infection resulted from puncture wounds or small lacerations. All patients were acutely ill, showed high temperatures, leukocytosis and signs of inflammation of the body area involved. Cultures of closed infections were attempted by aspiration but this technic did not prove useful.

In the twenty-one most serious cases an initial intravenous injection of 300 mg. of aureomycin dissolved in 500 cc. of a 5 per cent glucose in distilled water was given.†

TABLE I

Diagnosis	No. of Cases
Cellulitis with and without lymphangitis	42
Ischiorectal abscesses	9
Infected ulcers of the leg	5
Lymphadenitis	5
Traumatic cases:	
Human bite of hand	2
Traumatic amputation	2
Deep stab wound of thigh and buttock	1
Lacerated wound of neck and trachea	1
Thrombophlebitis of axillary vein and subclavian vein following laceration of finger	1 7
Gas gangrene infections	4
Carbuncles	2
Septicemia:	
Paracolon bacillus bacteremia	1
Aerobacter aerogenes bacteremia with meningitis	1 2
Rat bite fever	1
Urinary extravasation	1
Furunculosis, generalized, severe	1
Pyoderma of scalp	1
Erysipelas of face	1
Postpartum mastitis	1
Total	82

This was repeated twelve hours later. Beginning the second day 250 mg. of oral aureomycin was administered three times a day until the infection was controlled. In the remaining twenty-one cases the oral administration of the drug sufficed. In all instances there was marked clinical improvement as evidenced by reduction of temperature and decreased pain and swell-

† The aureomycin used was furnished through the courtesy of the Lederle Laboratories Division of the American Cyanamid Co., Pearl River, N. Y.

* From the Surgical Service and Department of Pathology of Harlem Hospital, Department of Hospitals, New York, N.Y. Aided by a grant from the Harlem Hospital Surgical Research Fund, Inc.

TABLE II
CELLULITIS

Series No.	Case No.	Age and Sex	Site	Organism Isolated	Total Dose in Gm.	Days under Treatment	Surgery
1	48-25609	42-F	Forehead	Beta hemolytic streptococcus; non-hemolytic staphylococcus albus	4.2	6	None
2	49-244	87-F	Chest wall	Beta hemolytic streptococcus	2.0	10	None
3	49-854	42-F	Leg	No culture obtainable	7.2	10	None
4	48-23699	48-M	Chest wall	Beta hemolytic streptococcus	5.1	7	None
5	49-330	29-F	Leg	Beta hemolytic streptococcus	3.7	6	None
6	49-1985	3-M	Forehead	Beta hemolytic streptococcus	5.2	7	None
7	49-1918	26-M	Forearm	Coagulase positive hemolytic; staphylococcus albus	5.2	7	None
8	49-100	38-F	Neck	No culture obtainable	10.8	15	None
9	*	46-M	Nose	Staphylococcus albus	4.0	3	Incision and drainage before therapy
10	49-2306	22-F	Buttock	Gamma streptococcus; escherichia coli	6.4	6	None
11	49-3988	22-F	Buttock	Anaerobic streptococcus; proteus vulgaris; corynebacterium pseudodiphthericum	2.3	4	None
12	49-4004	41-M	Forehead	Beta hemolytic streptococcus; non-hemolytic coagulase positive staphylococcus aureus	1.0	3	None
13	49-4236	34-F	Toe	Coagulase positive non-hemolytic staphylococcus aureus	3.6	6	None
14	49-4013	26-M	Ankle	No culture obtainable	2.0	5	None
15	49-1496	51-M	Face	Gamma streptococcus; staphylococcus albus	7.5	10	Incision and drainage cervical abscess third day of therapy
16	49-4003	30-M	Foot	No culture obtainable	6.7	11	None
17	49-4302	30-M	Hand	Beta hemolytic streptococcus; coagulase positive beta hemolytic staphylococcus aureus	5.2	7	None
18	49-4751	21-M	Wrist	No culture obtainable	2.8	4	None
19	49-4822	28-M	Elbow	Beta hemolytic streptococcus; staphylococcus albus	2.4	4	None
20	49-4806	24-M	Foot	No culture obtainable	2.4	4	None
21	49-4981	26-M	Hand	Beta hemolytic streptococcus; coagulase positive beta hemolytic staphylococcus aureus	2.4	6	None
22	49-5699	40-F	Face	No culture obtainable	5.2	9	None
23	49-6211	24-M	Neck	Culture negative	2.8	6	Aspiration second day of therapy
24	49-7014	74-M	Hand Forearm	Paracolon bacillus; staphylococcus albus, corynebacterium pseudodiphthericum; anaerobic streptococcus	6.0	9	Incision and drainage of hand seventh day of therapy
25	49-8502	25-M	Foot	No culture obtainable	4.5	6	Bleb broke third day of therapy
26	49-8842	65-M	Face	Aerobacter aerogenes; micrococcus sp.	8.1	11	Incision and drainage first day of therapy
27	49-8592	17-F	Thigh	No culture obtainable	12.0	16	None
28	49-8880	54-M	Leg	No culture obtainable	8.5	11	None
29	49-8486	44-F	Leg	No culture obtainable	10.6	15	None

* Series Case No. 9 from Post Graduate Hospital.

TABLE II (*Continued*)

Series No.	Case No.	Age and Sex	Site	Organism Isolated	Total Dose in Gm.	Days under Treatment	Surgery
30	49-8181	57-F	Leg	Hemolytic and non-hemolytic staphylococcus albus; Corynebacterium pseudodiphthericum	7.5	10	None
31	49-7999	49-F	Lip	Beta hemolytic streptococcus; non-hemolytic staphylococcus albus; micrococcus sp.	5.2	7	None
32	49-8534	29-M	Finger	No culture obtainable	5.5	11	None
33	49-8092	41-M	Hand	Staphylococcus albus; gamma streptococcus	9 7	13	None
34	49-8099	32-M	Foot	Coagulase positive hemolytic; staphylococcus aureus; beta hemolytic streptococcus	8.0	8	None
35	49-9285	17-M	Thigh	Escherichia coli	10.3	14	None
36	49-8447	15-M	Face	Coagulase positive hemolytic; staphylococcus aureus	13.5	18	None
37	49-9274	41-M	Hand	No culture obtainable	3.0	4	None
38	49-4698	25-F	Retroperitoneal	Escherichia coli; aerobacter aerogenes; beta hemolytic streptococcus; gamma streptococcus; corynebacterium pseudodiphthericum	20.0	20	None
39	49-8323	39-F	Knee	Beta hemolytic streptococcus	11.0	11	Incision and drainage first day of therapy
40	49-8303	39-M	Periurethral	Staphylococcus albus; corynebacterium pseudodiphtheri-cum	10 0	10	Incision and drainage second day of therapy
41	49-3230	40-M	Paronychia of toe	Hemolytic and non-hemolytic; staphylococcus albus; gamma streptococcus	6.6	11	Removed nail first day of therapy
42	49-566	6-F	Scalp	Beta hemolytic streptococcus	11.2	15	Ruptured spontaneously two days before therapy

ing within the first twenty-four hours. Response was so prompt that surgery was necessary in only seven cases. The total dosage of aureomycin used in each case varied from 1 to 20 Gm.

The results in these cases of cellulitis were uniformly excellent. All evidence of infection subsided promptly and steadily until the patients were discharged.

The following report of a phlegmon of the nose, which was treated at the Post-Graduate Hospital, is presented through the courtesy of Dr. Morris Kaplan.

Series Case No. 9. T. K., a forty-six year old physician, was admitted to the Post-Graduate Hospital on January 24, 1949, with a phlegmon of the right nasal vestibule, edema

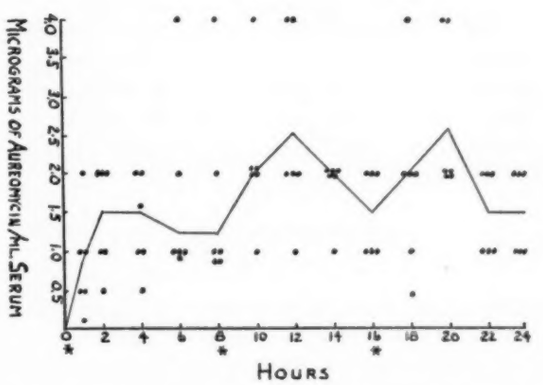

FIG. 1. Mean blood level curve obtained from six patients receiving 250 mg. of aureomycin orally three times daily; * = period of aureomycin administration.

of the upper lip and infraorbital region. A culture obtained on January 22, 1949, before admission to the hospital, showed staphylococci.

Incision and drainage were performed. The patient was given 600,000 units of penicillin in oil intramuscularly and 200,000 units in saline daily. On January 26, 1949, Staphylococcus aureus was obtained on culture. Sensitivity tests showed that the organism was resistant to penicillin and susceptible to aureomycin.

The patient failed to improve with penicillin therapy. On January 31, 1949, aureomycin was given orally in a dosage of 250 mg. four times a day. Twenty-four hours later the edema had subsided and on February 3, 1949, the patient was discharged, cured.

TABLE III
ISCHIORECTAL ABSCESSES

Series No.	Case No.	Age and Sex	Site	Organism Isolated	Total Dose in Gm.	Days under Treatment	Surgery
43	49-4952	32-F	Perianal	Escherichia coli; gamma streptococcus; paracolon bacillus	6.4	9	Spontaneous rupture fourth day of therapy
44	49-5709	54-M	Ischiorectal	None obtained	6.8	11	Incision and drainage before therapy
45	49-3197	34-M	Ischiorectal	Escherichia coli; staphylococcus albus	3.6	4	Spontaneous rupture before therapy
46	49-3729	33-M	Perianal	None obtained	5.0	5	Spontaneous rupture second day of therapy
47	49-4064	27-F	Perianal	Escherichia coli; anaerobic streptococcus	3.4	8	Spontaneous rupture fourth day of therapy
48	49-6752	26-M	Ischiorectal	None obtained	5.4	8	Spontaneous rupture fourth day of therapy
49	49-8497	35-M	Ischiorectal	Escherichia coli; beta hemolytic streptococcus	6.6	9	Incision and drainage fourth day of therapy
50	49-8022	22-F	Ischiorectal	Escherichia coli; staphylococcus albus; anaerobic streptococcus	5.4	8	Spontaneous rupture fourth day of therapy
51	49-3197	34-M	Ischiorectal	Gamma streptococcus; staphylococcus albus	5.2	7	Spontaneous rupture third day of therapy

ISCHIORECTAL ABSCESSES

Nine patients with ischiorectal abscesses were treated with aureomycin. (Table III.) Two patients gave histories of previous rectal operations for hemorrhoids or fistulas-in-ano. The temperature ranged between 99° and 102°F. in all cases.

In one case incision and drainage of an ischiorectal abscess had been performed before hospital admission. In another spontaneous rupture occurred before admission. Incision and drainage was performed in one patient after initiation of therapy. In the six remaining cases there was prompt cessation of pain after treatment with aureomycin. Spontaneous rupture of the abscesses occurred between the second and fifth days of therapy. The total dosage of oral aureomycin used varied from 3.4 to 6.8 Gm.

The patients were discharged between the fourth and eleventh days after admission, with clean, granulating wounds. In no instance did a fistula-in-ano result. Only once was it necessary to incise an abscess. Surgery was not indicated in the other cases.

INFECTED LEG ULCERS

Five patients were treated in this group. (Table IV.) Four of these patients were diabetics who had chronic ulcers of the feet, with surrounding cellulitis. In two instances there was also gangrene of the

toes. Fluctuant abscesses of the foot were incised in two patients at the onset of aureomycin therapy. Beta hemolytic streptococci were the most frequent primary infecting organisms. The diabetes in these patients was properly controlled with treatment.

patients were acutely ill on admission, with enlarged, tender lymph nodes, leukocytosis and a temperature range between 100° and 104°F.

In two cases the nodular masses were fluctuant and incision and drainage were performed at the outset. In another case

TABLE IV
INFECTED LEG ULCERS

Series No.	Case No.	Age and Sex	Site	Organism Isolated	Total Dose in Gm.	Days under Treatment	Surgery
52	49-861	59-F	Toe	Beta hemolytic streptococcus	13.3	20	None
53	48-23606	38-F	Foot	Pseudomonas aeruginosa; nonhemolytic staphylococcus albus	16.5	25	Incision and drainage at onset of therapy
54	49-476	49-F	Toe	Beta hemolytic streptococcus; coagulase positive hemolytic staphylococcus albus	24.9	34	Incision and drainage at onset of therapy
55	49-4011	56-M	Leg Foot	Escherichia coli; beta hemolytic streptococcus; proteus vulgaris; pseudomonas aeruginosa; micrococcus sp.	9.9	15	None
56	49-4683	55-M	Ankle	Proteus vulgaris; pseudomonas aeruginosa; gamma streptococcus	8.7	12	None

TABLE V
LYMPHADENITIS

Series No.	Case No.	Age and Sex	Site	Organism Isolated	Total Dose in Gm.	Days under Treatment	Surgery
57	49-2579	49-M	Supraclavicular	Culture negative	11.0	15	Aspiration second day of therapy
58	49-1136	38-F	Submental	Culture negative	15.9	25	Aspiration seventh day of therapy
59	49-4116	34-M	Submental	Anaerobic streptococcus; staphylococcus albus; micrococcus sp.	7.0	10	Incision and drainage fourth day of therapy
60	49-4292	18-M	Cervical	Beta hemolytic streptococcus; coagulase positive hemolytic staphylococcus aureus	2.4	4	Incision and drainage first day of therapy
61	*	45-F	Axillary	Staphylococcus albus	1.5	2	None

* Patient not admitted

Intravenous and oral aureomycin cured these patients of their infections.

LYMPHADENITIS

Five patients with acute bacterial lymphadenitis were treated. (Table v.) These

an axillary abscess ruptured prior to admission and the culture showed Staphylococcus albus. Two other patients received treatment before suppuration. Aspiration was performed in two instances and the fluid obtained was sterile.

The various infections were brought under control within three or four days but non-tender, palpable nodes persisted in some cases as long as twenty-five days. In all cases there was prompt, progressive reduction of temperature, pain and toxemia.

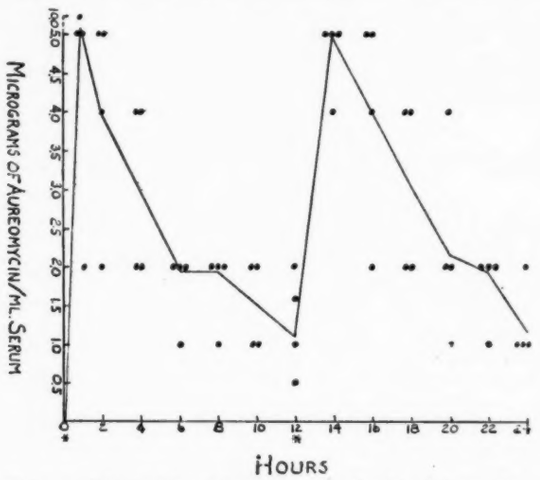

FIG. 2. Mean blood level curve obtained from four patients receiving 300 mg. of aureomycin intravenously twice daily; * = period of aureomycin administration.

TRAUMATIC CASES

In view of their clinical significance and response to aureomycin the following cases are briefly described:

Human Bite of the Hand. 1. A fifty-year old policeman (Series Case No. 62, Hospital Case No. 49-5043) was admitted with a history of having received a human bite on the right hand eight days previously. The injury was followed by pain and swelling of the entire right hand and forearm. Six days before admission his physician administered 600,000 units of penicillin in oil; this was repeated at two-day intervals.

On admission the dorsum of the hand and forearm was markedly tender, red and swollen and there was an ulceration about 3 cm. in diameter over the head of the third metacarpal bone. The base of the lesion was gray and necrotic and the extensor tendon to the finger could be seen. Flexion of the involved finger was absent. The organisms isolated from the ulcer were Streptococcus viridans, gamma streptococcus and Micrococcus sp.

Intravenous aureomycin, 500 mg., was given twice daily for two days. At this time the swelling was definitely reduced and the temperature had returned to normal. The wound was reduced to 1 cm. in diameter and was clean and granulating, with only slight drainage. Beginning on the third day the patient was given oral aureomycin, 250 mg., three times a day. After eight days the patient was discharged with the ulceration healed and complete motion of the finger.

2. A forty-one year old male (Series Case No. 63, Hospital Case No. 49-9274) was bitten on his left hand three days before admission. At the time of hospitalization a laceration surrounded by a 3 by 4 cm. area of swelling and tenderness was present over the thenar eminence. Lymphangitis was present, extending to the axilla where a tender lymph node measuring 1 by 2 cm. was palpable. No culture was obtained.

The patient was given 250 mg. of aureomycin orally twice daily. Two days after the institution of therapy the lymphangitis had disappeared. The patient was discharged as cured five days later.

The immediate and effective control of infection in these two cases of human bite is noteworthy.

Traumatic Amputation of the Thigh. A forty-one year old male (Series Case No. 64, Hospital Case No. 48-23699) who had been struck by a truck was admitted in shock. He had a compound fracture in the upper third of the left femur, with avulsion of the soft tissues. The white blood cell count was 10,000, with 80 per cent polymorphonuclear leukocytes, red blood cell count 2,000,000 and hemoglobin 8 Gm. Cultures revealed Clostridium perfringens, beta hemolytic streptococci, and Escherichia coli.

Whole blood transfusions and plasma infusions were given pre- and postoperatively. The amputation was completed and after extensive débridement of the soft tissues the wound was packed with gauze and the stump injected with penicillin. Large doses of penicillin and sulfadiazine were administered daily. The patient's temperature remained at about 101°F. and there was profuse foul drainage from the stump. Four days after admission the stump was again débrided and repacked. Penicillin and sulfadiazine therapy was still maintained but the discharge was not reduced.

Eleven days after admission when the patient's temperature had risen to 104°F. oral

aureomycin, 500 mg. twice daily, was given in addition to penicillin and sulfadiazine. On the following day the temperature dropped to normal for the first time since admission. At this time the combined penicillin and sulfadiazine therapy was discontinued in favor of aureomycin alone. This was attended by a definite gradual reduction of the foul odor and slough from the stump.

Fourteen days after admission the dosage of aureomycin was reduced to 250 mg. twice daily. One month after admission aureomycin was discontinued for a period of five days, during which time operative revision was performed. The patient's temperature rose postoperatively to 105°F. Intravenous aureomycin, 400 mg., was given for three days. The temperature became normal and remained so until the patient was discharged six weeks after admission.

Traumatic Amputation of the Leg. A forty-nine year old male (Series Case No. 65, Hospital Case No. 49-7361) who had been struck by a car was admitted to the hospital with a traumatic amputation of the right leg 2 inches below the knee joint. The patient was in shock and control measures were instituted. His temperature was 101.6°F. and tetanus and gas gangrene antisera were given. Culture revealed Aerobacter aerogenes and anaerobic streptococci.

The leg was disarticulated at the knee joint and the stump was left open and packed. Oral aureomycin, 250 mg., was given four times daily. Six days after admission his temperature became normal and remained so. Twelve days after admission the stump was clean, at which time it was revised and closed. Healing by first intention resulted.

These two cases indicate that aureomycin may be used either prophylactically or for the control of established infection in traumatic amputations.

Stab Wound of the Thigh. A thirty-nine year old male (Series Case No. 66, Hospital Case No. 48-1191) was admitted with deep lacerations of the left thigh and buttock sustained thirty minutes before. The laceration measured 12 by 6 cm. and extended to the femur on the lateral aspect of the thigh. A smaller laceration was present on the right buttock, exposing the gluteal muscles.

The wounds were débrided and closed. Gas gangrene and tetanus antisera were given. Twenty mg. of aureomycin was given intramuscularly daily. The wound healed *per primam* and the patient was discharged nine days later.

Lacerated Wound of the Neck and Trachea. An adult male (Series Case No. 67, Hospital Case No. 49-7256) was admitted with a severe laceration of the anterior triangle of the neck on the right side. A 2 cm. laceration was present in the trachea. After the insertion of a tracheotomy tube the wound was explored for major hemorrhage and then packed. Cultures taken on admission revealed A. aerogenes, Staph. albus and anaerobic streptococci.

Oral aureomycin, in 250 mg. doses, was given three times daily. At the end of one week there was no gross evidence of infection. The wound was granulating and the tracheotomy tube was removed. Three weeks after admission the patient was discharged, cured.

These two patients with deep, lacerated wounds responded well to prophylactic aureomycin therapy.

Thrombophlebitis of the Axillary Vein and Subclavian Vein following Laceration of the Hand. This case is presented through the courtesy of Dr. David J. Graubard. The patient (Series Case No. 68) was seen by one of the authors (L. T. W.) in consultation at Hunts Point Hospital on March 3, 1949.

On July 23, 1948, A. B., a forty-nine year old male, sustained a laceration of his left index finger. Several days later lymphangitis of the arm developed. He was hospitalized at the Wade Hospital, Brooklyn, and subsequently at the Manhattan General Hospital, in which institutions he was treated with penicillin, streptomycin and sulfadiazine. During this period chronic lymphadema of the left hand and wrist, secondary causalgia of the hand, subdeltoid bursitis and periarthritis of the elbow joint developed. There was loss of motion of the left arm, shoulder, hand and fingers.

Various procedures were carried out for the relief of pain and to increase the mobility of the affected parts but without avail. On December 28, 1948, there was a return of the swelling of the left arm and hand, with considerable inflammation. There was no response to chemotherapy. Between January 9 and January 13, 1949, the patient was hospitalized

at St. Clare's Hospital, with signs and symptoms of coronary thrombosis. On January 18, 1949, there was an exacerbation of the cellulitis of the left arm involving the shoulder, the acromioclavicular joint and part of the anterior left chest wall.

At this time the diagnosis was thrombophlebitis of a chronic, low grade type following laceration of the finger. It was believed that the thrombophlebitis had extended into the left subclavian vein and some of its tributaries. Although the patient was afebrile, he was acutely ill during this period.

On February 21, 1949, the left olecranon bursa was aspirated and cultures made of the fluid. An organism was isolated which, on some media, frequently presented the morphology of a staphylococcus but on other media, especially liquids, was found to have the characteristics of a pleomorphic diphtheroid bacillus. On February 25, 1949, a second culture from the same area showed Staph. albus. Sensitivity tests showed that both types of organisms were resistant to penicillin and sulfonamides and only slightly susceptible to streptomycin. However, both were susceptible to low concentrations of aureomycin.

Therefore, on March 18, 1949, the patient was given oral aureomycin and improvement in his condition was noted. However, after a few days the drug caused slight nausea and was discontinued.

On March 30, 1949, the patient again presented a swollen and tender left arm. The swelling involved the shoulder girdle and he was unable to flex his forearm. A small lymph node which was very tender was palpated in the supraspinous fossa.

At this time aureomycin was resumed in a dosage of 1 Gm. daily by the intravenous route. Pain and edema decreased promptly. The patient's general condition improved and he was able to go home April 18, 1949. When last seen there was no recurrence of symptoms and there was noted a gradual return of motion.

GAS GANGRENE INFECTIONS

In this group of four cases in two instances (Series Cases No. 69 and 70, Hospital No. 48-21861 and 48-20146) gas gangrene developed postoperatively in lower extremity amputations in spite of the fact that both patients were receiving penicillin. The other two patients (Series Cases No. 71 and 72) who had gas gangrene of the upper extremity had also received penicillin.

Cl. perfringens was isolated from three of the four patients, thus proving the diagnosis of gas gangrene. Secondary invaders included Proteus vulgaris, anaerobic streptococci, Esch. coli, gamma streptococci and hemolytic staphylococcus albus. In the other case (Series Case No. 69), which was one of gas gangrene of the stump of a mid-leg amputation, no cultures were obtained.

Each of the lower extremity infections was reamputated at a higher level after the diagnosis of gas gangrene had been established. They were treated with intravenous aureomycin.

In one patient, a sixty-one year old female (Series Case No. 69), marked crepitus of the soft tissues developed on the second day following a mid-leg amputation. Despite aureomycin therapy she followed a downhill course and expired. Autopsy showed massive pulmonary consolidation, pleural effusion, arteriosclerotic and hypertensive heart disease and gangrene of the amputated stump. In this case it is possible that our dose of aureomycin was inadequate, particularly in view of the massive pulmonary consolidation which developed.

The other case (Series Case No. 70) of gas gangrene following mid-leg amputation showed definite improvement under aureomycin treatment three days after stump revision. During this period the patient received intravenous aureomycin followed by oral aureomycin for thirty-five days. At this time there was no further evidence of infection of the stump.

Two patients (Series Cases No. 71 and 72, Hospital No. 48-19194 and 48-12834) had gas gangrene of the upper extremity. One was a severe asthmatic and the other a severe diabetic. Both had received large doses of penicillin for treatment of extensive cellulitis of the arm. Incisions and débridement were performed prior to aureomycin therapy. The patients were treated with aureomycin for the entire postoperative period and were discharged from the hospital, cured, approximately three weeks after operation.

The total dosage of aureomycin in these four cases ranged from 7 to 27 Gm. Aureo-

mycin has a definite place in the treatment of these infections in addition to adequate surgery.

CARBUNCLES

Two patients (Series Cases No. 73 and 74, Hospital No. 48-23891 and 49-884), ages thirty-nine and sixty-seven years, respectively, were treated in this group. One patient had severe associated diabetes. Both had exquisitely tender carbuncles approximately 10 cm. in diameter. The induration covered a still larger area. In the central area there were numerous tiny focal points from which pus drained. Cultures in both cases revealed gamma streptococci, coagulase positive beta hemolytic staphylococcus aureus and Sarcina lutea.

One patient was treated with oral aureomycin. On the second day the carbuncle had become more localized and fluctuant. Three days later under ethyl chloride anesthesia while in bed a 1 inch cruciate incision was made which released a moderate amount of pus. The patient made an uneventful recovery.

In the second case, no surgery was necessary.

SIGNIFICANT MISCELLANEOUS CASES

The following cases were of sufficient interest to warrant brief abstracts:

Paracolon Bacillus Bacteremia. A fifty year old female (Series Case No. 75, Hospital Case No. 49-788) complaining of fever and weakness was admitted on January 10, 1949. Prior to admission she had been in another hospital for six weeks where no causes for her fever could be found. Urine and blood cultures, agglutination tests and blood smears for malaria were all negative as were x-rays. The diagnosis was possible subacute bacterial endocarditis. Four million units of penicillin had been given daily for ten days. The fever continued and rose as high as 104°F.

On admission to Harlem Hospital the temperature was 101°F. Laboratory studies showed secondary anemia. Blood cultures on the day of admission and on the following day were positive for paracolon bacillus.

In the week following admission the patient received two transfusions of 500 cc. of whole blood. Beginning on her twelfth hospital day she was treated with 750 mg. of oral aureomycin daily. The fever continued until the eighteenth day when the patient had a chill and fever of 103°F. following a transfusion.

Beginning on the nineteenth day after admission 200 mg. of intravenous aureomycin were given twice daily. By the fourth day of this therapy her temperature had become normal and remained so. The patient was discharged as cured at the end of one month. When seen three months later she was entirely well.

A. Aerogenes Bacteremia with Meningitis. A four month old male infant (Series Case No. 76, Hospital Case No. 49-6640) was admitted on April 6, 1949. The mother reported the presence of fever, anorexia and loss of weight during the previous two weeks. On admission his temperature was 103°F.

Physical examination revealed an acutely ill infant. The anterior fontanel was bulging and nuchal rigidity was present. There were hyperactive reflexes and the extremities were spastic. The white blood cell count was 12,000, with 70 per cent polymorphonuclear leukocytes. The spinal fluid was cloudy and contained 460 white blood cells with 85 per cent polymorphonuclear leukocytes. Cultures of the blood and spinal fluid were positive for type 7 pneumococcus.

Penicillin, 100,000 units, was given every three hours, combined with sulfadiazine, 3¾ gr., every four hours. Intratibial infusions were given daily. Two days after admission the infant's temperature returned to normal and remained so for twelve days, during which time the blood and spinal fluid cultures were negative.

Fifteen days after admission the temperature rose to 104°F. A small pustule was seen at the site of the intratibial infusion in the left leg. The leg became progressively edematous and tender. Twenty days after admission cultures from the leg, blood and spinal fluid were positive for A. aerogenes.

The patient was given penicillin and sulfadiazone until May 4, 1949. During this period his temperature fluctuated between 103° and 104°F. Aureomycin, 125 mg. orally, was then given every six hours.

On the following day the temperature de-

creased to 100°F. and three days later was normal and remained so. On the fifth day of aureomycin therapy cultures from the wound, blood and spinal fluid were negative. The discharge, swelling and tenderness of the leg disappeared and after eight days of aureomycin therapy the patient left the hospital, cured.

Rat-bite Fever. This patient (Series Case No. 77) was treated at the Mount Sinai Hospital. This report is presented through the courtesy of Dr. Samuel Karelitz. One of the authors (A. P.) cooperated on this case.

P. F., a seven and a half year old male, was admitted in October, 1947, complaining of a cough and fever of three days' duration. At the age of three years he was bitten by an animal during a Florida hurricane, following which he had recurrent attacks of fever and the appearance of a macular rash. In 1946 he had suffered a head injury which resulted in left hemiplegia.

Physical examination on admission showed a chronically ill, poorly nourished child with evidence of pansinusitis and pneumonitis in both lower lung fields. There was a brown, crusted eschar 3 sq. cm. large on the right forehead; a similar lesion was noted on the left buttock at the site of an old penicillin abscess.

Examination of the skin lesions did not show any unusual bacteria or fungi. The laboratory studies revealed leukopenia and cultures from the ear, nose and throat showed Staph. albus. However, blood cultures revealed Spirillum minus.

The patient was maintained on high doses of penicillin but the blood cultures remained positive for S. minus. For eight months he received streptomycin, mapharsen and sulfadiazine without response. The dosage of streptomycin was increased and the patient was discharged after two blood cultures were reported negative.

Three weeks after discharge blood cultures again showed the presence of S. minus and the patient was readmitted to the hospital. The organism at this time was found to be susceptible to $\frac{1}{10}$ of 1 unit of streptomycin, 2 micrograms of aureomycin and 4 micrograms of chloromycetin.

On December 29, 1948, oral aureomycin, 500 mg. orally, was given every six hours and continued for ten days. The drug was then discontinued for ten days and the treatment reinstituted, using the intravenous route, 600 mg. in divided doses daily, for three days. Oral administration of 500 mg. every six hours was then resumed. Thereafter weekly blood cultures were negative.

At the time of discharge the patient was receiving decreasing amounts of aureomycin. His blood cultures continued to be negative but his nasal discharge and coughing increased. Maintenance dosage was raised to two capsules of 250 mg. daily to control the respiratory infection.

From May 4, 1949, to June 15, 1949, he was given no medication. During this period the blood cultures remained negative.

The patient was last seen on August 1, 1949, at which time the blood culture was negative and he was asymptomatic.

This case is of interest because the patient did not respond to intensive penicillin or streptomycin therapy. Dragisic[17] reported a case of S. minus infection cured with 700,000 units of penicillin. Salmon[18] reported a patient cured with 10,000 units of penicillin given intramuscularly every three hours for seven days. The S. minus infection reported here was resistant to penicillin but responded to aureomycin.

Urinary Extravasation. A thirty-three year old male (Series Case No. 78, Hospital Case No. 48-5834) was admitted to the hospital on March 21, 1948, with extensive urinary extravasation following dilatation of a urethral stricture.

Multiple incisions were made in the shaft of the penis and scrotum with the release of a purulent exudate. Suprapubic cystostomy was performed. Culture of the exudate revealed Esch. coli, gamma streptococci and paracolon bacilli.

Aureomycin, 20 mg. intramuscularly, was given daily for twenty-five days during which time there was gradual healing of the extensive sloughing wounds.

Furunculosis. E. D., a thirty-two year old policeman (Series Case No. 79) with multiple furuncles of the trunk and arms, was seen privately by one of the authors (L. T. W.) on September 1, 1948. He had been a victim of furunculosis for several years in the past. In 1947 he was treated at Harlem Hospital for one week, receiving massive doses of penicillin.

On physical examination there were multiple, tender, raised pustules on the trunk and face varying from 1 to 10 cm. in diameter. They were particularly extensive on the buttocks where they required dressings and prevented his sitting down. Cultures revealed coagulase positive staphylococcus aureus.

Penicillin, 600,000 units intramuscularly, was given daily for one week but the lesions continued to spread to the entire body. Those on the buttocks measured 7 cm., with marked surrounding edema.

Penicillin was discontinued and aureomycin, 40 mg. intramuscularly, was given daily for three days. After two days there was definite relief of the severe pain which had previously required narcotics. There was a rapid clearing of the draining lesions and the patient returned to work in one week.

Pyoderma of the Scalp. This patient (Series Case No. 80, Hospital Case No. 49-566) was a six year old male child with pyoderma of the entire scalp. Cultures revealed beta hemolytic streptococci.

Green soap shampoos and aureomycin given orally, 250 mg. twice daily, cleared the lesions and the patient was discharged, cured, on the tenth day.

Erysipelas of the Face. This sixty-six year old female (Series Case No. 81, Hospital Case No. 49-10597) was admitted with a severe erysipelas of the face. She had been treated previously for two days with penicillin but continued to have fever. The edema closed both eyes.

She responded to aureomycin given orally in two days and was discharged from the hospital on the third day, cured.

Postpartum Mastitis. This patient, a twenty year old female, was nine months postpartum (Series Case No. 82, Hospital Case No. 49-4739). She was still feeding her child by breast when fever, pain and swelling developed in the breasts.

On admission her temperature was 103°F. and both breasts were engorged. There was a red, tender, hot area surrounding the nipple of the right breast. The white blood cell count was 13,000, with 86 per cent polymorphonuclear leukocytes.

The patient was given 200 mg. of aureomycin intravenously twice daily for two days, at which time her temperature returned to normal. A breast binder was applied and on the third day oral aureomycin was started.

There was rapid disappearance of all signs of infection and the patient was discharged after three days of aureomycin therapy.

COMMENTS

The treatment with aureomycin of eighty-two patients with soft tissue infections has established its value as a therapeutic agent. In only one case in this series did the infection become more severe in spite of aureomycin therapy.

As expected, various types of organisms were isolated from the cases reported, with staphylococci and beta hemolytic streptococci predominating. These two organisms were the primary inciting agents of the vast majority of acute, localized or spreading infections such as cellulitis, carbuncles, furuncles and lymphadenitis. Gram-positive bacilli were the etiologic agents in only one type of infection, gas gangrene, whereas gram-negative bacilli were involved mainly in abscesses of, or near, the rectum. Two cases of septicemia due to gram-negative bacilli are reported. Various other micro-organisms such as Corynebacterium pseudodiphthericum, Pr. vulgaris, Pseudomonas aeruginosa, S. lutea, M. sp., etc., were at times isolated in the original culture from these infections. For the most part, however, they were considered to be secondary invaders.

Repeated cultures were obtained from many of the patients at intervals after the institution of aureomycin therapy. In many cases the infecting organisms could still be isolated as long as three or four days after the initiation of therapy even though the patient was greatly improved clinically. This is probably explained in part by the fact that aureomycin in the concentrations employed exerts mainly a bacteriostatic effect.[19] As the course of the disease progressed, many secondary invaders could be cultured from the diseased site; but these organisms, including Pr. vulgaris, Ps. aeruginosa, A. aerogenes and Esch. coli, apparently added little if anything to the pre-existing infection, nor did they perceptibly delay healing. It is quite

unlikely that these secondary organisms play any definite role in local infections that are open and draining.

It is to be noted that in the majority of cases only one or two species of bacteria were found initially. In only one case were more than four species found. The only negative cultures obtained were from closed infections from which fluid was aspirated and cultured.

Most of the patients in this study received either 300 mg. of intravenous aureomycin twice daily or 250 mg. of oral aureomycin three times daily. When given intravenously the drug was administered as an infusion in 500 cc. of 5 per cent glucose in distilled water. The infusion was adjusted so that the total dosage was administered within one hour.

The clinical effectiveness of aureomycin against various gram-positive and gram-negative bacteria is corroborated by laboratory studies which correlate the aureomycin blood level (Figures 1 and 2) with the *in vitro* sensitivity of these organisms (Table VI).* Although a higher level is maintained for the most part by the intravenous route, the sensitivity results suggest that the blood concentration of aureomycin resulting from the oral administration of the drug is sufficient to control most of those bacteria which were subjected to study. This fact was borne out clinically. On the whole our results were comparable whether aureomycin was given intravenously or orally.

Table VI shows that in general different strains of the same organism are inhibited by the same, or nearly the same, concentration of aureomycin. Also, there is apparently no increase in resistance to aureomycin in instances in which, presumably, the same organism was isolated more than once from the same patient.

Sensitivity tests were read at three intervals because aureomycin tends to deteriorate in the medium used. Therefore, the organisms generally grew in higher concentrations of the drug at twenty-four hours than they did at four or eight hours. One point to be stressed is the fact that an organism sheltered in an isolated pocket of tissue without adequate blood supply may not be readily eradicated even though it may be sensitive to that drug both *in vitro* and *in vivo*.

Additional sensitivity tests showed that the S. minus organism isolated from a case of rat-bite fever (Series Case No. 77) was inhibited by 2 micrograms of aureomycin per ml. while a Staph. albus and a C. pseudodiphthericum isolated from an extensive cellulitis of the arm (Series Case No. 24) were sensitive to 2 to 5 micrograms of aureomycin per ml.

No uncontrollable toxic reactions to the drug were observed. There were a few cases of nausea and vomiting during the use of oral aureomycin hydrochloride. However, oral treatment with aureomycin base did not provoke any gastrointestinal symptoms.

A chemical phlebitis occurred in approximately 15 to 20 per cent of our cases in which aureomycin was administered intravenously. This phlebitis was mild and subsided in a few days. In general it may be stated that the larger the dose administered intravenously the greater the possibility of phlebitis. Also, the chance of a chemical phlebitis developing is proportionate to the number of injections received. In over 1,000 injections of aureomycin no embolism has occurred and the only possible harm has been the occlusion of the vein. Since we have changed from the use of sterile distilled water to the use of a leucine buffer as a diluent, the phlebitis has been eliminated.

In respect to the specific infections treated the following facts were noted:

In all patients with cellulitis treated before actual necrosis and pus formation the infection subsided promptly. It did not in any case proceed to fluctuation.

Most of our cases of ischiorectal abscesses ruptured spontaneously. In others

* By kindness of Mr. A. C. Dornbush and Mr. E. Pelcak of the Lederle Laboratories, American Cyanamid Company, Pearl River, New York.

surgical intervention was indicated. In all cases there was a definite reduction of systemic evidence of infection upon treatment. With the use of aureomycin rectal surgery can now be done in many instances as a definitive procedure in the absence of gross infection.

It should be emphasized that the cases of lymphadenitis reported here are primary diseases and not lymphadenitis secondary to a constitutional disease.

Four cases of gas gangrene infections are reported. Excellent results were obtained in three of these clostridial infections. In the fourth case (Series Case No. 69) in which the patient was senile and had extremely severe arteriosclerosis, the infection was not controlled.

The most impressive observation of the carbuncle cases was the fact that within forty-eight hours of systemic drug therapy the general toxicity was relieved, the pain

TABLE VI
IN VITRO SENSITIVITY OF BACTERIA TO AUREOMYCIN

Series No.	Case No.	Date Isolated	Organism Isolated	Micrograms of Aureomycin per ml. Causing Complete Inhibition of Visible Growth		
				4 Hr.	8 Hr.	24 Hr.
73	48-23891	12/3/48	Hemolytic coagulase positive staphylococcus aureus	0.195	0.195	0.39
4	48-23699	1/11/49	Beta hemolytic streptoccus	0.039	0.156	0.312
74	49-884	1/11/49	Hemolytic coagulase positive staphylococcus aureus	0.39	0.39	1.56
7	49-1918	1/26/49	Hemolytic coagulase positive staphylococcus aureus	<0.097	0.195	1.56
		1/28/49	Hemolytic coagulase positive staphylococcus aureus	<0.097	<0.097	1.56
54	49-476	2/23/49	Pseudomonas aeruginosa	3.12	3.12	12.5
		2/23/49	Staphylococcus albus	12.5	12.5	50.0
		2/23/49	Beta hemolytic streptococcus	0.39	0.078	0.156
53	48-2306	2/23/49	Pseudomonas aeruginosa	3.12	6.25	25.0
17	49-4302	3/3/49	Hemolytic coagulase positive staphylococcus aureus	<0.097	<0.097	0.195
		3/3/49	Beta hemolytic streptococcus	0.039	0.039	0.312
13	49-4236	3/1/49	Coagulase positive staphylococcus aureus	<0.097	0.195	0.195
60	49-4292	3/3/49	Hemolytic coagulase positive staphylococcus aureus	<0.097	<0.097	0.39
21	49-4981	3/13/49	Hemolytic coagulase positive staphylococcus aureus	<0.097	0.195	0.195
	49-1365	2/23/49	Proteus vulgaris	12.5	25.0	100.0
*	49-1507	1/26/49	Coagulase positive staphylococcus aureus	<0.097	<0.097	0.195
		1/29/49	Alcaligenes fecalis	0.195	0.78	1.56
*	49-2048	1/28/49	Escherichia coli	0.78	0.78	1.56
		1/29/49	Escherichia coli	0.78	0.78	1.56
		1/31/49	Escherichia coli	0.78	0.78	1.56
		2/2/49	Pseudomonas aeruginosa	6.25	6.25	25.0
		2/4/49	Pseudomonas aeruginosa	12.5	12.5	50.0
*	48-23867	12/3/48	Proteus vulgaris	12.5	12.5	50.0
*	49-2743	2/9/49	Paracolon bacilli	0.78	0.78	0.78
*	49-3041	2/13/49	Streptococcus viridans	0.048	0.39	0.78
*	49-3471	2/22/49	Aerobacter aerogenes	1.56	3.12	6.25
		2/24/49	Aerobacter aerogenes	0.78	0.78	6.25
		2/22/49	Klebsiella pneumoniae	0.048	0.097	0.19
		2/24/49	Klebsiella pneumoniae	0.048	0.097	0.39

* Patients from a separate study

was reduced and the progressive nature of the acute inflammation ceased. One full-blown carbuncle receded so rapidly that incision was not necessary.

Patients with the following medical complications were treated: diabetes, arteriosclerosis, asthma, peripheral vascular disease and heart disease. The only instance in which such a complication defeated aureomycin therapy was the case previously described in which severe arteriosclerosis greatly reduced the blood supply to an infected thigh. So far as we were able to observe the other conditions did not influence the effectiveness of aureomycin nor did they constitute contraindications to the use of the drug.

The age of the patient has not influenced the activity of the drug.

Aureomycin was used effectively by the oral, intramuscular and intravenous routes. No criteria for effective dosage have been established. No resistance to the drug has developed in any organism in cases in which prolonged administration was necessary.

SUMMARY

Aureomycin was used in eighty-two surgical infections of the soft tissues which have been divided into the following groups: cellulitis, perirectal infections, peripheral ulcers, lymphadenitis, traumatic cases, gas gangrene infections and a miscellaneous group.

Infections caused by a variety of gram-positive and gram-negative bacilli were successfully treated. Most of these infections were caused by staphylococci or beta hemolytic streptococci. The miscellaneous group includes a case of bacteremia by the paracolon bacillus and one by S. minus.

The age of the patients and medical complications have not hampered the activity of the drug.

Aureomycin was used effectively by the oral, intramuscular and intravenous routes.

Blood level studies and *in vitro* sensitivity tests have been performed and have confirmed the clinical results. No resistance to the drug has developed in any organism in cases in which prolonged administration was necessary. No serious clinical signs of toxicity have been seen as a result of drug administration. A chemical phlebitis developed in approximately 15 per cent of the patients receiving the drug intravenously if its administration extended two days or longer.

In our hands aureomycin has yielded satisfactory results in the treatment of the reported infections whether used alone or as an adjunct to indicated surgery. It has appreciably shortened the clinical course of some infections, for example the lymphadenitis cases. In other infections such as cellulitis the usual rate of surgical intervention was markedly reduced during its use. In perirectal infections the use of the drug made early definitive surgery possible by reducing the local infection.

Further use of aureomycin in the field of soft tissue infections seems definitely indicated.

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Splenectomy will help almost all sufferers with so-called primary splenic panhematopenia in spite of the fact that the removed spleens appear normal and there is no definite evidence that excessive phagocytosis exists in these patients. Presumably the spleen has some sort of regulatory action on some functions and activities of the spleen and probably the reputed beneficial effects that follow splenectomy are explainable on this basis. (*Richard A. Leonardo, M.D.*)

SOFT TISSUE COVER OF DEFECTS OF THE LOWER EXTREMITY

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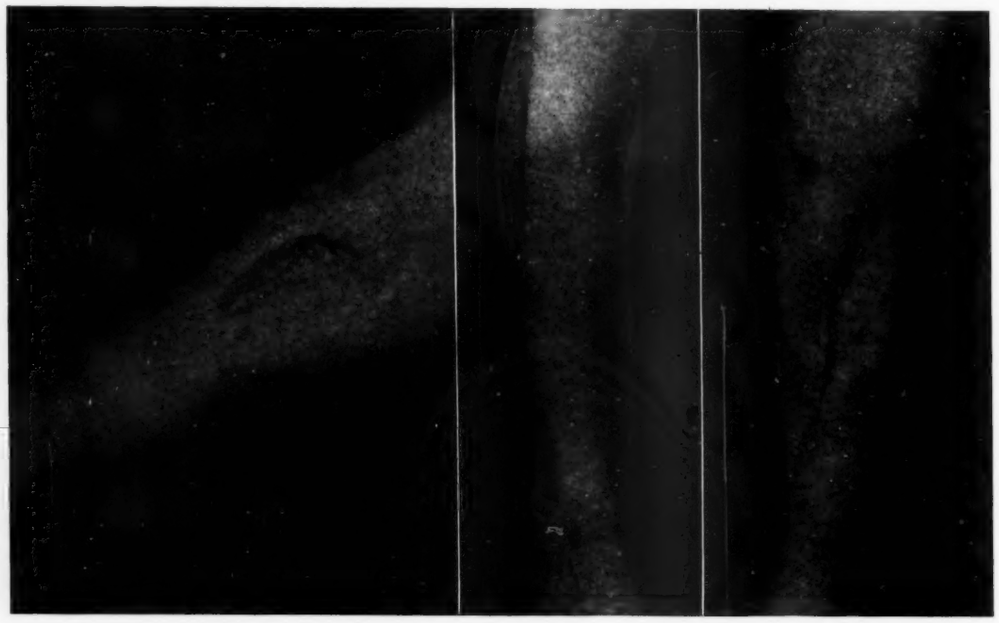
THE problem of soft tissue defects of the lower extremity is largely one of adequate cover to replace the unstable scars or to provide a suitable field for contemplated bone or tendon surgery.[1] In some instances the cover is adequate in itself. The operative scar of a secondary closure is able to withstand normal trauma; however, because of the increased space requirements of a large bone graft, more cover is needed.



1A 1B 1C

FIG. 1. A, B and C, healed fracture of tibia, right; a double pedicle shift was used to cover a shallow anteromedial defect.

There are two types of cases in which, we believe, plastic surgery is seldom indicated. In this category are those patients who have suffered severe compounding injuries with marked tissue loss around the ankle joint and foot. The injuries are complicated by recurrent or persistent osteomyelitis, bony fusion in malposition, shortening of the heel cord and varying degrees of anesthesia. In the second class are those with marked scarring on the weight-bearing surfaces with bone damage.

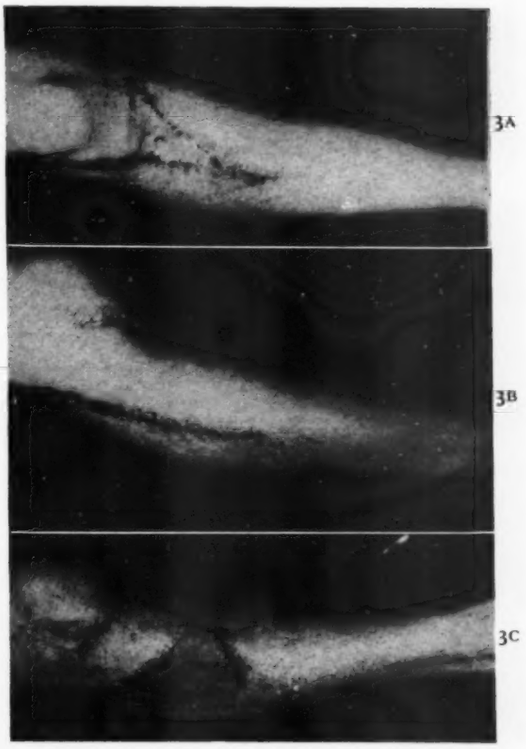
In our experience the former group of patients usually has such marked changes that walking is impossible because of severe pain or recurrent ulcer formation. In the latter group we have found that the pedicle cover withstands weight-bearing poorly. Many of these cases are now eventually coming to amputation.

"A number of techniques are available to the surgeon, and a method applicable to the individual case at hand should be selected."[2] If the defect is over muscle or soft tissue, simple excision and closure or excision and skin graft will suffice. When

2A

2B 2C

FIG. 2. A, B and C, a double pedicle shift was used to cover two defects on the front of the leg in a case of bony fusion of the knee.



3A

3B

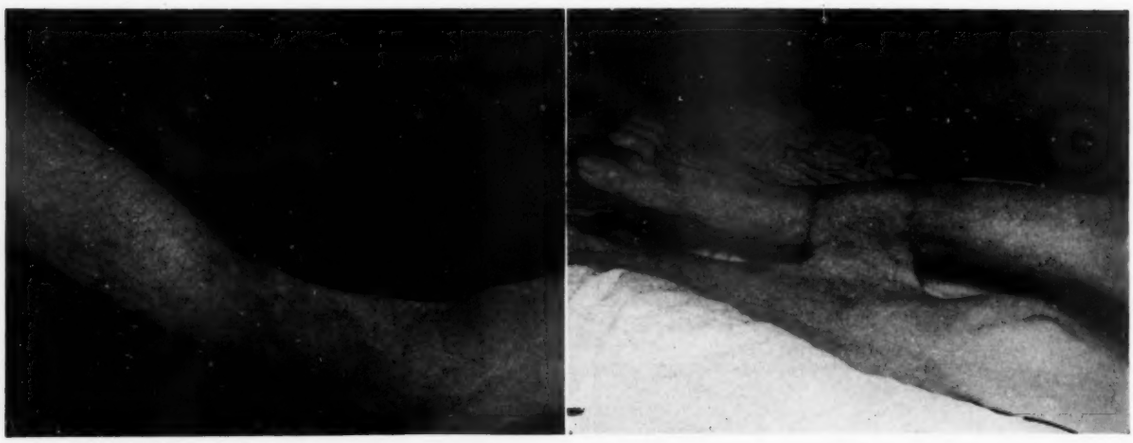
3C

FIG. 3. A, B and C, a local flap was used because of the good circulation about the knee and its simplicity.

the defect is over bone or tendon, pedicle tissue usually is required.[3]

This paper deals with the various types of pedicle tissue and the indications for each. The source and the method to be employed in obtaining this tissue is determined by the location of the defect, its size and the type of bone and tendon surgery contemplated. We attempt to simplify our procedure as much as possible. When it is feasible, we prefer to use tissue adjacent to the defect. Unfortunately, the defects we have encountered usually have been too extensive for this type of procedure. In these cases, in the further interest of simplicity and speed we have attempted to use some variation of the open flap. Abdominal tube pedicles are of great value in selected cases. We reserve their use to situations in which the other extremity is not available as a source of an open flap or in which such a flap would be unsuitable.

Double Pedicle. This procedure should be limited to linear defects in the upper two-thirds of the leg or thigh where the split graft of the secondary defect does not encroach on the tibia, popliteal space or the Achilles tendon. When there is bony fusion of the knee, the skin graft may be carried across the popliteal space with no fear of contracture. The double pedicle cannot be used to cover a cavity unless the latter is shallow. Occasionally the space can be filled with a small local flap of muscle or fat at the time the pedicle is shifted. This is an excellent procedure but limited in its application. We have found it desirable to delay the pedicles at least once when their elevation involves undermining extensively around the knee joint. (Figs. 1 and 2.)



4A 4B

FIG. 4. A and B, jeep accident August 12, 1944, resulting in non-union of the tibia. This case illustrates the fact that the flap should be broad, extending into normal tissue around it. This is especially true in cases showing pigmentation and induration about the defect.

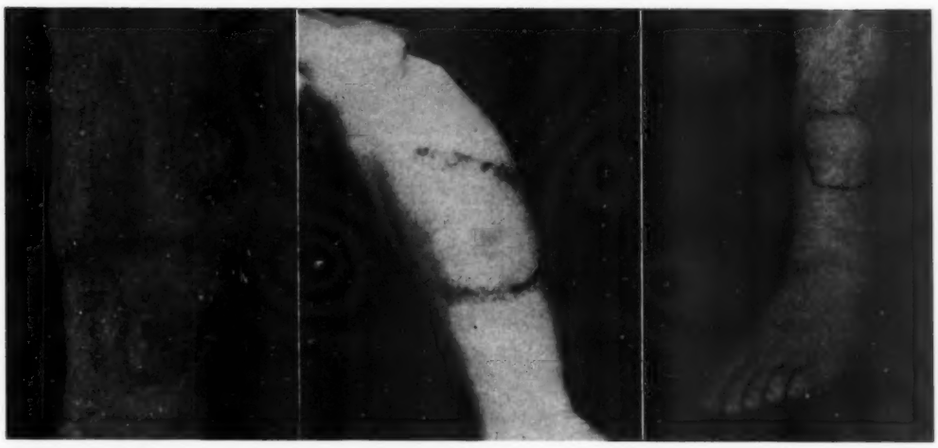
5A 5B 5C

FIG. 5. A, B and C, a cross-leg flap from opposite calf was used in preparation for a bone graft. Note the skin graft used to line the flap and bed.

Transposition or Local Flap. This procedure has limited application and is fraught with some danger. Many of the same principles apply as in the case of the double pedicle. It is useful in the upper third of the leg where a double pedicle shift would be difficult and is especially valuable about the knee where there is good circulation. Whenever possible the bases of these flaps should be near the point of emergence of a blood vessel through the fascia as, for example, the collateral vessels at the knee joint. This procedure consequently has little application in the distal third of the leg. (Figs. 3 and 4.)

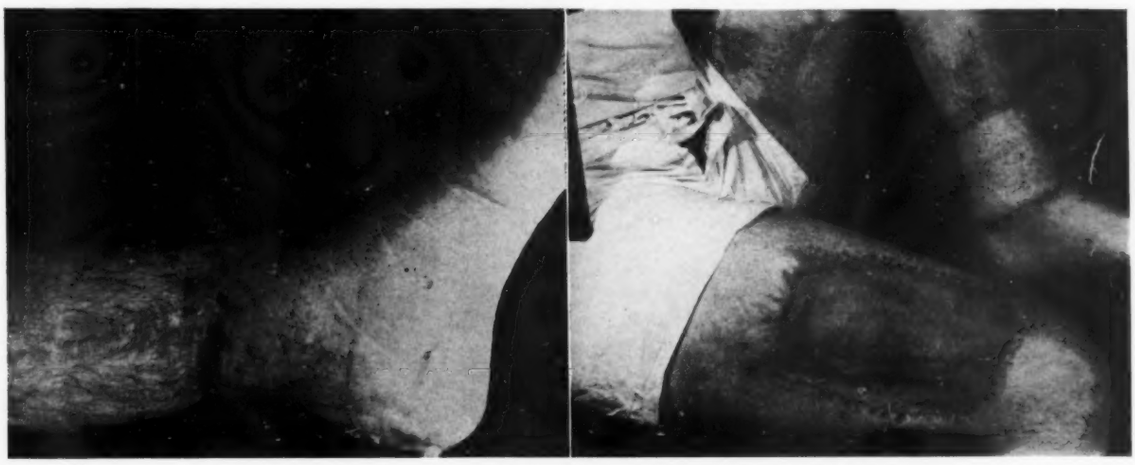
Calf Flaps, Cross-Leg. This procedure is the method of choice in handling defects of the leg requiring pedicle cover from a distant area. These flaps may be used either direct or retrograde and on any surface of the leg except over the tibia. The ideal flap is one based directly on either the posterior or posteromedial surface since the greatest blood supply to the skin comes from the recurrent vessels about the medial aspect of the knee. (Figs. 5 and 6.)

Thigh Flaps. A fairly large percentage of lower extremity defects are located in the distal third of the leg. If the deformity is a "rat hole" in the bone, a tube pedicle is often required. If the defect is in the nature of adherent scar or atrophic skin graft overlying the tibia or the Achilles



6A 6B 6C

FIG. 6. A, B and C, non-union of tibia; required pedicle cover in preparation for bone graft.



7A 7B

FIG. 7. A and B, non-union of tibia; cross-thigh flap was used because of its availability and the great volume of tissue required.

tendon, we employ the open thigh flap because of its simplicity and the time-saving factor.[4] (Figs. 7 to 9.)

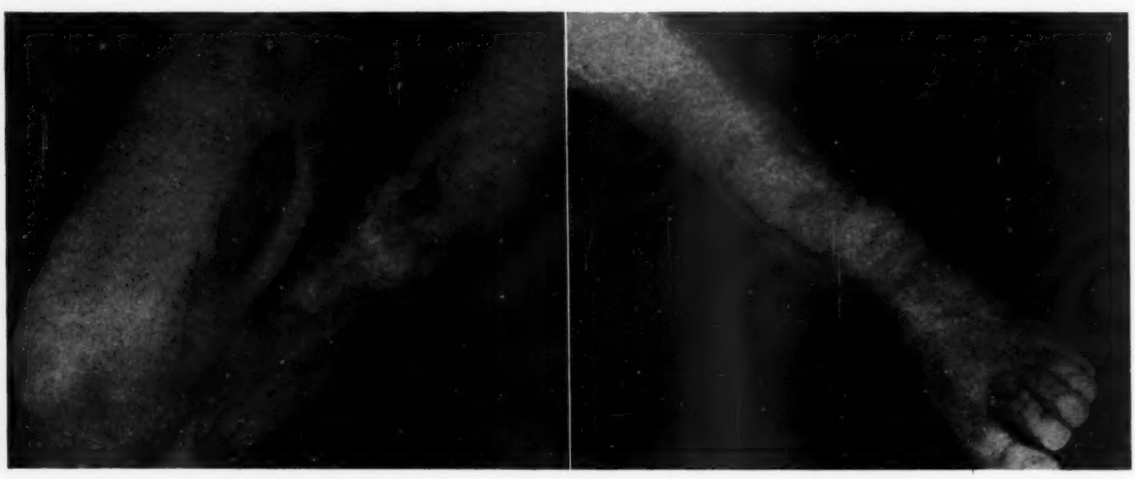
We prefer this method to the calf flap. It is less involved mechanically, being more direct. These thigh flaps may be either direct or retrograde. Of course the former is preferred but the recurrent vessels about the knee are adequate to the demands of either. Flaps on the lateral aspect of the thigh require a longer time to develop an adequate blood supply than those on the anterior or medial surfaces. If the defect on the leg can be covered with a short, broad flap, this flap can be attached directly at the time of its formation. These primary flaps should be outlined so that the base is broad. Their length should rarely exceed the width of the base.

The point in favor of the thigh flap is the large amount of tissue of reliable blood supply which can be secured. Its disadvantages lie chiefly in the fact that these flaps are thicker than calf flaps and the patient's position is not as comfortable. We prefer not to use them on the foot because of their bulkiness and slow acquisition of sensation.[5]

Thigh Tube. We wish to mention thigh tubes only as a matter of record. We have done a few but do not believe that they are as satisfactory as the open flaps; the time involved is usually much greater. In cases in which thigh tubes might be indicated, we

8A 8B 8C

FIG. 8. A, B and C, a retrograde thigh flap was used to replace the adherent cicatrix in preparation for orthopedic work.



9A 9B

FIG. 9. A and B, gunshot wound; required pedicle cover for an onlay bone graft and triple arthrodesis.

use the tubed abdominal pedicle carried at the wrist.

Open Abdominal Flap. The open abdominal flap or "jump flap" is first attached to the forearm.[6] After appropriate delays it is migrated to the defect. (Figs. 10 to 12.)

Its use should be limited to carefully picked cases. It is most useful in those cases in which it is necessary to move a large mass of tissue. The defect must be located so that the move is mechanically feasible.[7] A mass of pedicle tissue 8 by 9 inches has been moved in fourteen weeks. The disadvantages of this method are the short pedicle, which makes positioning tedious, and the difficulty in achieving a completely closed system, which we believe is vitally necessary when bone is likely to be exposed.

Abdominal Tube to Extremities. This procedure is reserved for all defects which are so located and of such a nature that none of the aforementioned methods are suitable.

Many of the bony cavities which have been lined by a split graft must be covered by a tube pedicle.[8] In these instances the tube is allowed to bridge the defect until it has gained adequate circulation. It is opened, the lining of the bony cavity removed and the defect filled with cancellous bone chips. The opened tube is then used to cover the bone chips. The

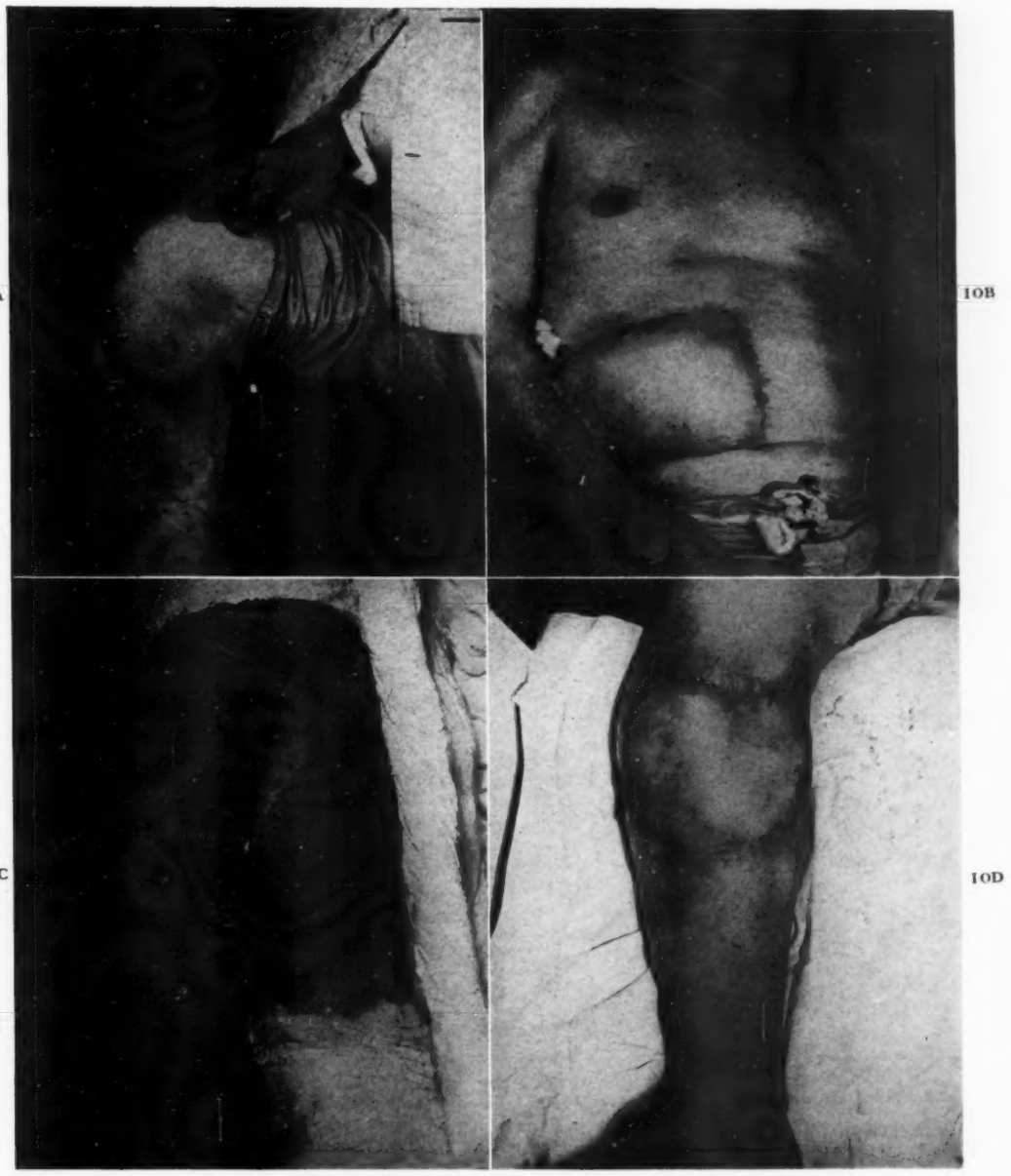


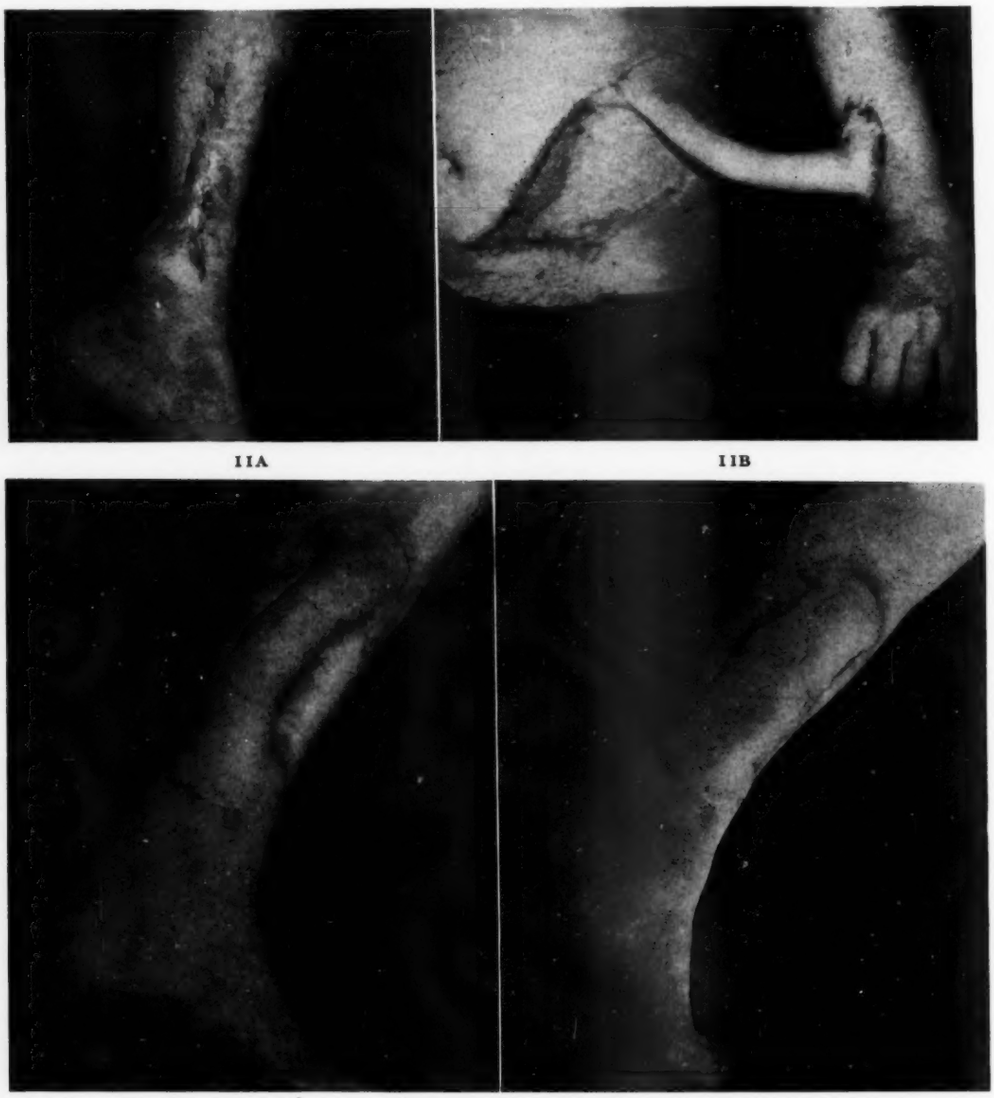
FIG. 10. A, B, C and D, patient had a defect 8 by 9 inches. The location and size of the defect dictated the use of an open abdominal flap. Mechanically these must be perfect.

tube pedicle is particularly useful in long defects on the surface of the leg. The fat carried in the tube is a great aid in filling in gutter-like defects in the bone. This method is also of value in cases of multiple defects on a single extremity. Its disadvantages lie chiefly in the time required for completion and the slow return of sensation.

We believe that the attachment to the wrist is the vital step in this procedure. All parts should be encased in a plaster cast since any compromise of the wrist attachment places the tube in jeopardy throughout its course.

COMMENT

We have made no mention of the preparation of the recipient site. The general principles of bed rest, elevation, pressure dressings, excision of ulcers and skin graft to secure healing are well known. Occasionally it is necessary to cover open areas



11A 11B

11C 11D

FIG. 11. A, B, C and D, traumatic amputation of the right leg; an abdominal tube pedicle was used, because of the opposite leg amputation and the nature of the defect, to replace the unstable cicatrix.

with pedicle tissue. These areas must be surgically clean and even then the procedure is not without a calculated risk.

We have had some experience with precasting for leg and thigh flaps. This is a procedure of merit but is time consuming, allows little latitude for last minute changes and there is some danger of compromising the sterile fields. In the hands of a meticulous and patient surgeon this procedure contributes materially to the comfort of the patient and the morale of the operating room personnel.

The technic of these procedures is not stereotyped but there are a few guiding principles. These are simply the maintenance of blood supply and freedom from infection. We have avoided the subject of the methods of delays since we believe that there must be considerable latitude. Each flap or tube must be considered individually and its physical condition used as a guide to the next step.

SUMMARY

The problem of coverage of soft tissue defects of the lower extremity is presented.

12A 12B

12C

FIG. 12. A, B and C, patient required pedicle cover in preparation for a bone graft.

In view of its simplicity and speed, the writers prefer some variation of the open flap wherever possible.

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ABDOMINAL TRAUMA

A CLINICAL STUDY OF 200 CONSECUTIVE CASES FROM THE MASSACHUSETTS GENERAL HOSPITAL

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THE interest in abdominal trauma occasioned by the recent war has led us to review the experience of the Massachusetts General Hospital with injuries of this type that have occurred since 1930. It is pertinent to ascertain wherein civilian and military experiences resemble or differ from one another and to determine what lessons of military surgery may profitably be applied in civilian practice.

For this purpose the records of 200 consecutive cases of abdominal trauma have been reviewed. These represent all such injuries treated in the public or private wards of the hospital between January 1, 1930, and April 30, 1948.

It must be recognized that this hospital does not receive the majority of persons suffering from trauma in this city since most of these patients are taken to municipal institutions. However, the series of cases provides a typical cross-section of the patients observed in this community during this period.

This comparative study emphasizes several important features: (1) The group of patients differs in several important respects from that observed in military practice; (2) the operative mortality has declined significantly in recent years; and (3) the methods of treatment are applicable equally to both groups of cases.

COMPARISON OF WAR AND CIVILIAN EXPERIENCE

Churchill[1] has stated that military surgery is "the surgery of trauma encountered in epidemic proportions." The overwhelming truth of this statement is borne out in Table I. In seventeen months of service on active battle fronts, approximately thirty surgical teams of the Second Auxiliary Surgical Group[2] treated 3,154 abdominal injuries whereas in the Massachusetts General Hospital there were only 200 cases in eighteen and a half years. In a large civilian hospital of this type abdominal trauma is a rare condition.

TABLE I
INCIDENCE OF ABDOMINAL TRAUMA IN CIVILIAN AND MILITARY EXPERIENCE

	Total Cases	Cases Abdominal Trauma	Incidence (Per cent)
Massachusettss General Hospital (18½ yr.)	262,659*	200	0.08
Second Auxiliary Surgical Group (17 mo)	22,000 approx.	3,154	13.0

* Hospital admissions only

War injuries are nearly exclusively wounds by penetration. Blunt or subcutaneous abdominal trauma is exceptionally unusual. This situation is reversed in civilian experience in which the majority of injuries are sustained as the result of vehicle accidents, falls, etc. (Table II.)

TABLE II
TYPE OF TRAUMA

	Penetrating		Blunt		Total
	Cases	Per cent	Cases	Per cent	
Massachusetts General Hospital	28	14.0	172	86.0	200
Second Auxiliary Surgical Group	3,137	99.5	17	0.5	3,154

It immediately becomes apparent that the problem of diagnosis of visceral injuries is much more difficult in the civilian group. In the presence of an open wound

no particular diagnostic acumen is required to determine the necessity of a laparotomy if it is recalled that the peritoneal cavity may be penetrated by any missile entering between the neck and mid-thigh or if the course of a perforating missile is reconstructed. This is as true in civilian wounds as in military wounds; so bullet wounds, stab wounds or other obvious penetrations demand exploration.

On the other hand, the diagnosis of visceral trauma is much more difficult if it is due to blunt force. Here there is often no evidence of contusion of the abdominal wall so that other diagnostic features must be considered. It is necessary to emphasize the minimal nature of the trauma in some of these cases. For example, one patient ruptured his spleen by falling from a fence only 3 feet high and another sustained the same injury in a fall on a wrestling mat. Falls account for about 40 per cent of the injuries due to blunt trauma. Auto accidents in which the victim either was struck by the vehicle or was a passenger account for 20 per cent. The remainder are due to accidents of various types.

In the case of blunt trauma it is unusual for more than one viscus to be damaged. In this series of 172 cases of non-penetrating injury eight patients had two viscera injured, one had three and the remainder (163 or 94.8 per cent) had damage to only one organ. This is in contrast to the effects of penetrating wounds, particularly those due to explosives, in which multiplicity of organ injury is the rule. In the 3,154 war injuries previously mentioned there were 1,348 or 42 per cent who had damage to a single organ.[2]

In the examination of patients with abdominal injury the following signs and symptoms must be observed and their significance evaluated:

1. In the absence of other shocking injury (e.g., severe fracture) shock is a grave finding and implies extensive concealed hemorrhage, contamination by gastrointestinal contents or both. Towery[2] has shown that in penetrating wounds of the hollow viscera the gravity of the prognosis is directly proportional to the degree of shock. The same is true in the small series reported herein consisting predominantly of blunt trauma. (Table III.)

TABLE III
RELATIONSHIP OF DEGREE OF SHOCK TO MORTALITY (MASSACHUSETTS GENERAL HOSPITAL SERIES)

Degree of Shock	None	Mild	Moderate	Severe	No Record	Total
No. of cases	133	32	16	14	5	200
No. of deaths	6	2	6	12	0	26
Mortality per cent.	4.5	6.3	37.5	85.7		

2. The diffuse pain of peritonitis is readily appreciated but patients with abdominal trauma seen in civil life are usually brought to the hospital so promptly that diffuse peritonitis has not become established. Hemoperitoneum associated with ruptures of the spleen has been a nearly constant cause of pain. In this series there were thirty cases of injury to the spleen in which records are complete, the patients were conscious and the spleen was the only organ injured. Pain was noted by twenty-seven of the thirty.

However, pain is not a constant accompaniment of visceral damage. (Table IV). Twenty per cent of patients having visceral injury had no pain.

TABLE IV
RELATIONSHIP OF ABDOMINAL PAIN TO VISCERAL INJURY

	Visceral Injury	No Visceral Injury
Cases	155	27
Pain present	124	19
Per cent with pain	80.0	70.4

(Patient unconscious; children; etc: 18 cases)

3. The absence of peristalsis in the presence of abdominal injury is fair presumptive evidence of peritoneal contamination and is a strong indication for operation. In this series there were twenty cases of recent abdominal injury in which a hollow viscus was perforated. The pres-

ence or absence of peristalsis was noted in sixteen of these cases; in only two was it found present. In one of these it was described as "diminished" while in the other a loop of small bowel had been perforated but was effectively walled off from the peritoneal cavity by old adhesions.

TABLE V
ASSOCIATION OF SPECIFIC FRACTURES WITH VISCERAL INJURY

Organ	Total Cases	Associated Fracture	Cases	Per cent Visceral Injury with Fracture
Bladder....	8	Pelvis	7	87.5
Spleen.....	38	Left ribs 8–12	7	18.4
Kidney.....	90	Ribs 8–12	9	10.0
Kidney.....	90	Trans. Proc. D8-L2	7	7.8

4. The presence of diffuse abdominal tenderness may connote peritoneal contamination or hemoperitoneum and is usually an indication for surgery. Tenderness may be absent in the presence of significant injury; this is particularly true of the cracked spleen which is quiescent for a few days and later gives rise to secondary hemorrhage.

5. Spasm and tenderness usually coexist and are evaluated together. If rigidity of the abdominal wall is found, it is a further indication for operation. The distinction of tenderness and spasm originating within the abdominal wall from those of peritoneal insult is at times difficult.

6. Shifting dullness, the classic sign of intraperitoneal effusion, should dispel any doubt that surgery is indicated unless there is a history of previous ascites. It usually means extensive hemoperitoneum and was rarely seen.

7. Vomiting has been unusual in our experience. When observed it has occurred late in most instances as a result of ileus. The absence of vomiting in no way precludes the possibility of visceral injury.

8. Vomiting of blood after abdominal injury usually signifies a perforation of the stomach. The gastric contents should be evacuated with the Levin tube in all cases of suspected visceral damage and examined for blood by chemical test. The absence of gross blood from the gastric content does not rule out a perforation of the stomach.[2]

TABLE VI
PER CENT FREQUENCY OF VISCERAL INJURY IN TOTAL SERIES

Viscus	Massachusetts General Hospital (200 Cases) (Per cent)	Second Auxiliary Surgical Group (3,154 Cases) (Per cent)
Kidney.....	45.5	13.5
Spleen.....	19.0	10.8
Liver.....	9.5	27.0
Small bowel.....	4.5	37.0
Colon.....	5.0	35.1
Bladder.....	4.0	4.9
Abdominal wall only.	11.0	0.5

9. Blood in the urine should be sought always, by catheterization if necessary. Its significance must be correlated with other findings as it may point to injury of any part of the urinary tract.

10. While fresh blood by rectum is encountered only rarely, a digital examination should always be made and, if blood is found, proctoscopic examination carried out.

11. The presence of fractures is demonstrated in Table v. Thus, with fractures of any of the eighth, ninth, tenth, eleventh or twelfth ribs, kidney or splenic injuries are to be suspected. Hepatic injuries also must be considered although none of them appeared concomitantly with these fractures in this series. Fractures of the transverse processes of the lumbar vertebrae should suggest a contusion of the kidney or the spleen. Fractures of the pelvis are associated with injuries to the urethra and bladder. Conversely, rupture of the bladder is encountered very rarely except in the presence of fractured pelvis.

Besides the difficulty of diagnosis the preponderance of blunt trauma leads to another distinguishing feature between

civilian and war wounds, namely, an entirely different incidence of injuries to the various viscera. With penetrating abdominal wounds it was found that viscera were injured in direct proportion to the amount of space occupied by each viscus. On the other hand, solid viscera are the more susceptible to injury by the transmitted effects of blunt force. Thus the kidney, spleen and liver, in this order, are most commonly injured in civilian trauma while the three viscera most frequently involved in military injuries were the small intestine, colon and liver. These data are summarized in Table VI.

MORTALITY

The mortality of abdominal injuries in a comparable series of cases in the Massachusetts General Hospital for a thirty-year period ending in 1930 studied by Allen was 44.0 per cent. In common with all other types of surgery there has been a significant decline in mortality in the last fifteen years. In this study all patients who entered the emergency ward alive are included in the statistics. A few died within a few minutes so that only emergency shock therapy could be instituted. When death occurred, the bodies were taken by the medical examiner; and in nearly all of these cases the autopsy findings were unknown. Therefore, although the cases are included in the mortality statistics, the exact visceral damage could not be ascertained.

When the mortality figures for the entire series are studied (Table VII), it is found that the over-all mortality rate is 13.0 per cent; while in the past five years it has decreased to 3.1 per cent. If the cases are subdivided into perforating and blunt trauma, it is found that the mortality from perforating wounds is only about half that in the other group (7.7 per cent versus 14.0 per cent). This is due chiefly to two factors: (1) The difficulty of diagnosis makes blunt trauma more serious than penetrating, and (2) several patients with severe trauma who died soon after entry were included in the blunt trauma group. However, it is of interest that no patients have succumbed from penetrating wounds of the peritoneum in the last ten years.

Analysis of all deaths discloses that four patients died because of too long a time lag (twenty-four hours or more); two patients treated conservatively should have been operated upon and one died because of an improper operative procedure (removal of a solitary kidney). These seven deaths we believe were preventable. The other nineteen deaths appear to have been inevitable if the therapeutic facilities available in the given years are considered as well as the severity of associated injuries.

TABLE VII
MORTALITY

	Blunt			Penetrating			All Cases Mortality Per cent
	Cases	Died	Mortality Per cent	Cases	Died	Mortality Per cent	
1930–1937	57	11	19.3	11	2	18.9	19.1
1938–1942	59	11	18.6	8	0	0	16.4
1943–1947	56	2	3.6	9	0	0	3.1
Totals	172	24	14.0	28	2	7.7	13.0

TREATMENT

This drop in mortality indicates that the same factors that have been emphasized in military practice have been appreciated by surgeons dealing with civilian injuries. Errors apparent in early cases have been eliminated to a great extent in the later ones. The most important errors of the past include, in retrospect: (1) failure to use the gastric suction tube and to empty the stomach preoperatively; (2) an inadequate number of whole blood transfusions; and (3) poor anesthesia including both the type employed and the method of administration.

A brief summary of the correct management of these injuries includes several important features. The necessity for vigorous resuscitation of abdominal casualties has been thoroughly emphasized. Recognition that whole blood is the ideal

replacement material in the shock seen in these patients is one of the major contributions of military surgery. Equally important is the realization that adequate early operation is an integral part of resuscitation. Beecher[4] has pointed out the danger of overdosage of morphine. This drug is preferably given intravenously and in small dosage in the presence of peripheral vascular collapse. Failure of the patient to respond to adequate resuscitative measures within one or two hours indicates persistence of the shocking effect of the injury; in these cases laparotomy with continuing resuscitative measures is indicated. Prolonging of the time interval from injury to surgery increases the gravity of the prognosis.[2]

Military experience has taught that nitrous oxide-oxygen-ether by closed endotracheal technic is the anesthesia of choice in abdominal injuries. The use of curare in competent hands has been of aid in military surgery, particularly for prolonged procedures in shocked patients when a light plane of anesthesia is desirable.[5]

The preoperative preparation of the patient must include gastric intubation and lavage; the gastric (Levin) tube should be on suction during the operation. Operative procedures must be rapid, complete and well planned. The methods of dealing with injuries to the various viscera have been previously described and will be further discussed. Adequate chemotherapy should be instituted before operation and continued thereafter. The lessons and experiences of military surgeons with regard to resuscitation, anesthesia and timing of operation can be applied with great profit by the civilian surgeon.[6]

The effects of trauma upon the various organs need not be considered in detail since they have been described previously and the treatment of injuries of the individual viscera has been standardized. However, a few details which apply to the special group of civilian injuries should be emphasized.

The Genitourinary Tract. Patients suspected of having an injury to the urethra and bladder should be catheterized. Inability to pass the catheter suggests urethral trauma while gross clots indicate at least a contusion of the bladder. The bladder should be irrigated and quantitative measurements made of the irrigating fluid. Inability to obtain an equivalent return indicates a laceration of the bladder; this can be confirmed by a cystogram. A simple contusion of the bladder is by far the most commonly observed lesion and is treated by constant urethral drainage and bladder irrigations. Rupture of the bladder or a severe laceration of the urethra through which a catheter cannot be passed requires suprapubic cystotomy and repair.

While injuries to the lower genitourinary tract are unusual and except for a rare instance observed only in the presence of a fractured pelvis, traumatic lesions of the kidney are common. The diagnosis is usually made on the basis of hematuria that can either be gross or microscopic. Many patients have received a comparatively insignificant blow to which they have paid little attention but the presence of gross hematuria brings them to the hospital. Usually after one or two episodes of frankly bloody urination the urine gradually clears without specific treatment.

It has been the practice in this hospital to obtain an intravenous pyelogram in all such cases. If there is normal filling of the calyces and pelvis on both sides, spontaneous improvement may be expected. Occasionally there is no filling on one side indicating a clot in the pelvis. If there are only trivial local signs, the patient may be watched and the intravenous pyelogram repeated. If the block persists, if there is marked local reaction with no filling of the pelvis or if the intravenous pyelogram indicates extravasation of the dye in the parenchyma, a retrograde pyelogram is indicated. If the laceration does not extend through the capsule, such injuries nearly always subside with no further treatment. Complete laceration or fragmentation of

the kidney demand an exploration with nephrectomy necessary in most instances.

The striking feature in this series has been the large number of simple contusions of the kidney and the rarity of lesions severe enough to warrant operation. In other words, conservative therapy of genitourinary trauma is indicated much more frequently in civilian than military practice.

There were seven deaths among all cases of renal injury. In four the kidney damage was not of primary significance and death was due to other more severe injuries. One patient died following removal of a ruptured solitary kidney. One died without operation and at autopsy was found to have had a severely ruptured spleen, a ruptured kidney and contusion of the opposite kidney. Operation rather than expectancy would probably have saved his life. The last death was that of a twenty-eight year old woman who underwent removal of a completely fractured right kidney. She died in uremia with a progressive, severe anemia. The cause of death was not established.

The Spleen. There were thirty-eight cases of ruptured spleen. Laparotomy was performed in thirty-six of these and splenectomy was accomplished in thirty-four. In the two operative cases without splenectomy the splenic injury was minor and extensive other injuries precluded the procedure. There were five deaths (a mortality rate for all cases of 13.2 per cent). Of the thirty-four patients having splenectomy, two died (a mortality rate of 5.9 per cent). One patient died in 1934 in whom a severe thoraco-abdominal wound was managed by laparotomy. The diaphragmatic rent and pneumothorax could not be controlled and the patient died immediately following operation. This death would be avoidable today with transthoracic technics. The other death occurred in 1932 apparently as a result of inadequate resuscitation in a severely shocked patient. This fatality also would probably be averted today.

The Liver. Hinton[7] pointed out in 1929 that bleeding from a damaged liver has usually ceased by the time of operation. This operation was confirmed by Madding and Lawrence[2] who reported that among 829 cases of liver wounds, significant persisting hemorrhage was found at operation in only 9 per cent. These authors recommended that use of the liver pack be discontinued inasmuch as serious complications following packing of the liver were frequent.[8] Allen[3] reported twenty-four cases of liver injury from this hospital in 1931; it is of interest that of sixteen patients packed with gauze, twelve died.

Madding and Lawrence advocate laparotomy with drainage of all liver wounds because of the potential danger of bile peritonitis. Allen thought that if the danger of hemorrhage could be eliminated, no treatment to the liver would be necessary. In the present small series in which the liver was not drained in thirteen of fifteen patients operated upon, there were no untoward results. Three patients postoperatively had courses suggestive of bile peritonitis but all recovered. It is possible that the bile canaliculi possess enough stability to withstand the relatively minor trauma encountered in civilian life and that the incidence of biliary leaks is considerably reduced. From this small experience it would not appear that drainage of all wounded livers is mandatory. However, we agree with Madding and Lawrence that laparotomy with institution of drainage in all cases is the safest management.

The Gastrointestinal Tract. Wounds of these viscera were comparatively uncommon. The principles laid down in military practice are applicable throughout to this group and we see no reason to suggest any revision.

Non-operative Treatment, Diagnostic Laparotomy. It must be reemphasized that any penetrating wound of the abdominal wall requires exploration under good operating conditions with satisfactory anesthesia. Laparotomy was performed in sixteen cases (8.2 per cent) in which the

findings did not justify the procedure. These explorations were done because of doubt regarding the pathology and may be termed "diagnostic laparotomies." However, there were only five patients in whom the abdominal cavity showed no evidence whatever of trauma.

By contrast there were sixteen patients treated non-operatively with a diagnosis of injury to the abdominal wall only. There were severe complications in two of these patients with prolonged febrile courses and vomiting in one; both patients apparently had visceral injuries probably to the liver. In a third patient a pelvic abscess developed which required drainage. The foregoing patients recovered. Two patients treated expectantly died and unquestionably had visceral injuries which might have been surgically relieved, proved in one case by autopsy. The combined morbidity and mortality in the non-operative cases was 31.3 per cent. This substantiates our belief that unless one can be very certain that there is no significant intraperitoneal injury, laparotomy is definitely indicated. The surgeon under these circumstances should feel no embarrassment in accepting an occasional error in preoperative diagnosis or in performing a seemingly unwarranted laparotomy.

SUMMARY

A study of 200 patients who entered the Massachusetts General Hospital with abdominal trauma during the years 1930 to 1948 has shown that these injuries differ significantly from those observed in military practice. Because blunt rather than penetrating injuries are preponderant, diagnosis is more difficult and the frequency of involvement of the various viscera greatly altered. Mortality figures have declined significantly and progressively in the past fifteen years. Methods of diagnosis and treatment are considered briefly.

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AN ERECT METHOD OF MYELOGRAPHY*

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THIS article proposes a procedure in myelography which may be divided into two parts, namely, the physiologic positioning of the patient to facilitate the production and demonstration of a herniated nucleus pulposus and the utilization of greater amounts of contrast medium.

Before discussing this method of myelography a recapitulation of the composite endeavors of many physicians in the evolution of the procedure is in order.

Shortly after the discovery of x-ray by Wilhelm Röntgen, E. Sehrwald[1] of Freiburg showed that roentgen rays were absorbed by chlorine, bromine and iodine to a considerable extent and suggested that organs filled with solution of these elements would be more readily radiographed.

Myelography as such was first utilized by Dandy[2] in 1918 who used air as a contrast medium. The ease of the procedure and the ever increasing technical efficiency of the x-ray apparatus made this a new and useful mode of spinal canal examination. Dandy was rapidly emulated by other enthusiasts such as Wideroe, Coggeshall and Von Storch.[3] In a report by Chamberlain and Young[4] of a series of cases of air myelography the physiologic approach to the demonstration of protruded intervertebral discs was first suggested. These writers indicated that such lesions might be influenced by flexion and hyperextension. The limitations of air, however, as a contrast medium soon became apparent as the patient could not assume the upright position and visualization was not as definite as with opaque contrast medium.

In 1923, Sicard, Paraf and Laplane[5,6] described a new method with the use of an iodized oil (lipiodol) as a contrast substance. This had many advantages such as non-miscibility with spinal fluid, heavy specific gravity and low toxicity. The major difficulty encountered was the irritability of the substance necessitating its complete removal. The removal itself was troublesome because of the viscosity and tendency towards globulation.

In 1931 Arnell and Lidstrom[7] suggested the use of skiodan (abrodil) for myelography because of its reabsorbability from the spinal fluid. Its miscibility, poorer contrast and irritating effect never were conducive to general acceptance.

In 1932 Radovici and Meller[8,9] used thorium dioxide (thorotrast) and obtained excellent contrast. The radioactivity, extreme toxicity and fixation in the reticulo-endothelial system negated its slight advantage over lipiodol.

Doub and Sanford[10] in 1941 described a very original and ingenious method of air epidurography, a procedure in which 200 to 600 cc. of air are introduced into the epidural space as the contrast substance. The disadvantages of this procedure were the necessity of using the lateral projection only, two lumbar punctures and a skilled team.

In November, 1940, pantopaque (ethyl iodophenylundecylate) developed by Strain, Plati and Warren[11] was first used. It is the best medium thus far, being twenty-two times less viscid than lipiodol, having little or no irritating effect on the spinal membranes and possessing a high specific gravity. The simple procedure of its usage and removal is well described by Ramsey[12] et al.

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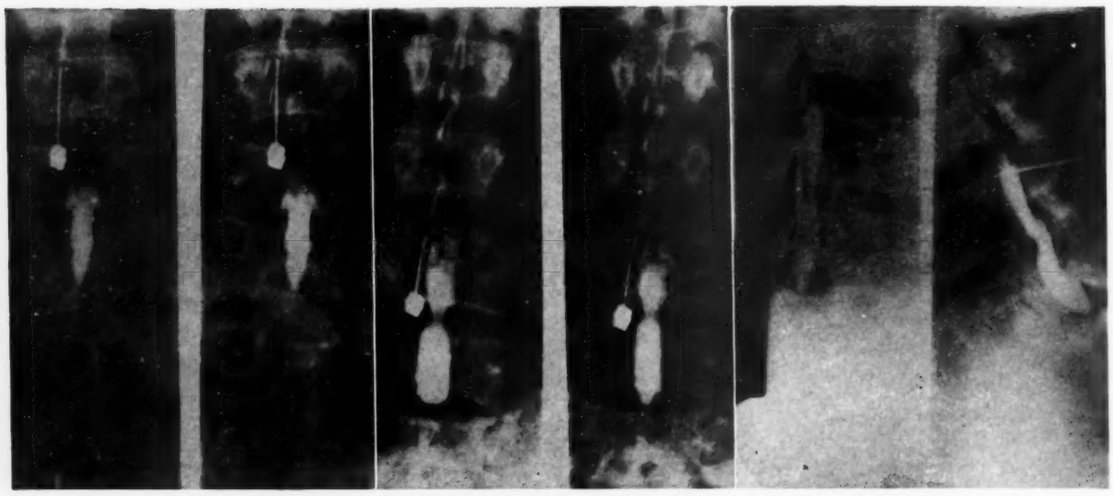

1A 1B 1C

FIG. 1. Common method of myelography with the use of 3 cc. of pantopaque; disc demonstrated at L-4. A, anteroposterior projection with the medium over a normal interspace; B, anteroposterior projection with the medium over the pathologic interspace; C, oblique and lateral projections with the medium over the pathologic interspace.

COMMON METHOD OF MYELOGRAPHY

The general technic of myelography practiced presently, except for local variations, is as follows. Following sterile precautions and local anesthesia a lumbar puncture with an 18–22 gauge needle is performed one interspace above or below the suspected disorder. After entering the subarachnoid space 3 to 5 cc. of spinal fluid are removed and 2 to 3 cc. of pantopaque are slowly injected. Following this the patient is put in a prone position on the fluoroscopic table and slowly tilted in either direction while the opaque column is visualized for defects. Spot films are taken. Oblique or lateral projections are manditory in some instances. (Fig. 1A, B and C.) After fluoroscopic localization beneath the needle the pantopaque is removed by the Kubik and Hampton[13] or the Valsalva procedure.[14]

PHYSIOLOGIC TECHNIC OF MYELOGRAPHY

Following the usual sterile lumbar puncture technic and local anesthesia a sharp, short-beveled, 18 gauge spinal puncture needle is introduced in the midline, with the bevel pointing cephalad. It is preferable to use the interspace between L-3 and L-4 as this is the apex of the normal lumbar lordotic curve. The needle at this level facilitates the removal of the pantopaque as it naturally pools in this region. Experience has proven it more difficult to withdraw the medium when the needle has been inserted in the interspace between L-2 and L-3 because of the increased frequency of nerve root blockage to the needle and the lack of pooling at this level. The interspaces, L-4 and L-5, and L-5 and S-1, should not be used because these areas are the most frequent sites of herniation. The needle trauma may also cause a defect in the column simulating disc protrusion by producing localized extra dural bleeding from the anterior plexus of vessels.

The size of the needle used is most important. We have found that a No. 18 spinal needle is the smallest caliber feasible. If a smaller caliber is used, great difficulty will be encountered in withdrawing the medium at the end of the procedure.

Having completed the spinal puncture 12–15 cc. of cerebrospinal fluid are removed. This is collected and later examined for cells, total protein, chlorides, Wassermann and colloidal gold. Twelve cc. of pantopaque in a previously prepared 20 cc. syringe is slowly injected into the subarachnoid space. This should be accomplished with ease. If resistance is encountered, the

FIG. 2. Erect method of myelography with the use of 12 cc. of pantopaque; disc demonstrated at L-5. A, posteroanterior projection with disc well demonstrated; B, left anterior oblique projection; C, right anterior oblique projection; D, left lateral projection.

position of the needle must be checked by fluoroscopy. After the pantopaque has been introduced, the stylette of the needle is reinserted. The needle is covered with sterile gauze and remains in position throughout the entire procedure.

Turning the patient to the prone position, the table is tilted until the erect position is reached. The patient then walks to an upright Bucky and exposures are made in the upright weight-bearing posture in the following projections: posteroanterior, right and left obliques, and lateral. The lateral exposure is either left or right depending upon the side of the patient's objective and subjective symptoms. (Fig. 2A, B, C and D.) As the increase in downward force is more liable to produce a protrusion in case of a sliding type of disc, it is often practical to have the patient hold weights in both hands.

The patient walks to the tilt table and

is returned to the prone position. The column of pantopaque is localized in the upper lumbar disc areas or other areas of suspected disorders by fluoroscopic visualization. Spot films can be made of these regions in the posteroanterior or oblique planes if indicated. When tilting the patient to visualize the upper lumbar region, care should be taken that the medium does not cascade by the normal dorsal kyphosis into the cranial cisterns.

Removal of the pantopaque is accomplished by pooling the center of the column at the needle point under fluoroscopic control. With a sterile 2 cc. syringe a slow, but steady aspiration of the pantopaque is performed. It has been found that all but perhaps a few drops of pantopaque can be quickly removed in this manner. The Valsalva technic can also be used but it lengthens the procedure. The complete procedure time from initial puncture to withdrawal of the needle varies from twenty to thirty minutes.

The usual contraindications to a spinal tap are observed. Most authors speak of previous spinal taps within a ten day period as a contraindication because of possible extravasation outside the subarachnoid space. We have not found this to occur. If a bloody tap is encountered, postponement of the examination is manditory.

The advantage of this method is to demonstrate a defect more readily, thereby facilitating the diagnosis of disc protrusion. This pathologic disorder is best demonstrated in that position where the greatest stress and strain is placed upon the intervertebral disc which is most commonly produced in the standing, flexed and hyperextended positions. The best and simplest position for examination is the erect, normal, weight-bearing position. To better illustrate this we will cite two cases.

CASE REPORTS

Case No. 12996. After the pantopaque was placed in the subarachnoid space and the patient was fluoroscoped, the myelography was considered normal demonstrating no defect in the column. The patient was then tilted into the erect position and walked a short distance for the upright Bucky exposure. A film examination was made which very clearly and definitely revealed a defect consistent with a protruded disc. On refluoroscoping the patient following film examination the herniation was definitely demonstrated. Operation was performed at a later date and a large disc was removed.

Case No. 9726. A definite diagnosis of intervertebral disc protrusion had been made by myelography and by clinical evaluation. At operation the interspace at and above the location of suspected disorder was investigated and protrusion could not be demonstrated. The operating table was adjusted to flex the patient's back but no herniation could be visualized. Upon straightening the table the disc was clearly evident.

From these cases the following deductions are logical: (1) Protruded discs are not always static affairs but may herniate and retract. This partially explains why subjective and objective clinical findings of protruded disc and myelographic evidence of herniation occurs; yet it can not be substantiated at operation. (2) The usual procedure of bed rest and traction commonly employed tends to reduce protrusions, producing normal myelographic findings. To counteract this difficulty upright myelography is preceded by having the patient out of traction and walking for several hours.

Another advantage of this method is brought about by the use of 12 cc. of pantopaque instead of the usual 2 to 3 cc. This appears to be a large quantity of pantopaque and a long, difficult period of withdrawal is envisioned. Familiarity with the use of large quantities of medium quickly demonstrate that in removal it is the last cubic centimeter which presents the greatest difficulty and time consumption, regardless of whether 2 or 11 cc. proceed it. The added ease with which the diagnosis of disc protrusion can be made outweighs the only disadvantage found, namely, the slight increase in cost due to the greater quantity of medium used.

This increased amount of pantopaque is manditory in order to fill the subarachnoid space to the level of L-3 in the upright position, thereby covering the most frequent sites of disturbance. It has been observed that the small defects caused by the irregularities due to the dentate attachment and other subarachnoid variations are not exaggerated and not given undue importance as commonly occurs when small amounts of pantopaque are used.

SUMMARY

A physiologic method has been described in which myelography is performed in the erect, weight-bearing position with the use of 12 cc. of pantopaque and the best available film technics. The most severe critics[15] of myelography present statistical reports of 13 per cent false negatives and 4 per cent false positives by myelographic diagnosis alone. The method herein described tends to increase the accuracy of diagnosis by demonstrating many of the so-called sliding herniations or reducible protrusions by the use of the physiologic position. Therefore, it most ably produces the disorder at the time of myelography and reduces considerably the 13 per cent false negative diagnoses presently encountered.

The use of 12 cc. of medium by its greater volume and more adequate three dimensional filling of the subarachnoid space reduces the 4 per cent false positive diagnoses by diminishing the magnitude assumed by small irregularities of the subarachnoid space. Its greater bulk and availability prevents non-pathologic asymmetrical filling of the root sheaths from giving a false impression of disc protrusion.

By the use of an upright Bucky apparatus readily available in most institutions and offices films of the best available technical quality are produced, thereby negating most of the technical radiographic errors encountered in myelography.

CONCLUSION

A technic of myelography is presented characterized by the utilization of the following: (1) erect posture or physiologic position, (2) 12 cc. of opaque medium (pantopaque) and (3) upright Bucky radiography in posteroanterior, both oblique and lateral positions.

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THREADED WIRES AND PINS FOR LONGITUDINAL MEDULLARY FIXATION OF FRACTURES OF THE HUMERUS, RADIUS, ULNA AND TIBIA*

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SEVERAL years ago one of us (P. H. H.) reported a method of treatment of fractures of the olecranon in which the displaced proximal fragment was immobilized by the passage of one or two long, slender threaded stainless steel screws into the medullary canal of the proximal third of the ulna. The advantages of early motion of the elbow and lack of necessity of plaster-cast support were so striking that we have extended the method by modifying the fixation materials. During the past two years we have treated thirty fractures of the shafts of the long bones, chiefly the humerus, the forearm and the tibia utilizing medullary fixation by longer threaded wires and pins of various sizes. This application to fractures of the shafts of the long bones has depended upon the development of slightly flexible threaded pins from a special type of 18–8 SMO stainless steel. Pins used according to the technics described in this publication must be sufficiently hard to withstand severe torsional and angular stress but still remain slightly flexible and not be brittle. The composition of the steel used in these pins and the required physical properties of the special 18–8 SMO alloy stainless steel are given later.

By coincidence the bones to which this technic is especially applicable are the same as those with which various surgeons have experienced difficulty in the use of the Küntscher nail for medullary fixation. These difficulties are well expressed by one authority[2,3] as: "Some time ago, feeling that our results were unsatisfactory in fractures other than those in the femur, we reviewed all of our cases. The review indicated that, in bones other than the femur, the results were better by conservative methods than with nailing. . . . Because of these complications and because healing may be greatly delayed through minor technical errors, the authors have completely abandoned the use of the intramedullary nail in the tibia. These findings were emphasized even more strongly in ununited fractures and in compound fractures. . . . The use of the nail has also been discontinued in forearm fractures, for the same reasons. In fracture of a single bone of the forearm, coaptation can be maintained by simpler means. If intramedullary fixation is used in fractures of both bones, it is necessary to fix both bones. In the radius, as in the tibia, the bent nail is undesirable." One of the important features of the technics described in this article is the ability of the fixation material to conform to the curve of the cortical bone of the medullary canal of the long bones.

This work has also had its inspiration in the use of Kirschner wires and other similar materials for medullary fixation, especially in fractures of the forearm, by a number of surgeons.[1,5,6,8,9,12,14–19,22–25,27,29–33] A number of authors have used Kirschner wires and beaded Kirschner wires for transverse and oblique fixation of fractures and dislocations. Bunnell and Howard have reported upon the use of a transversly placed Kirschner wire for the purpose of preventing motion at the radial-ulnar joints. A

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preliminary report of our technic has already appeared (1948).

This method of fixation and the relatively early mobilization of the entire extremity satisfy many of the requirements which must be met in the open operative treatment of fractures and the aftercare. These principles have been ably described,[23] "The open reduction of fractures followed by plaster immobilization results in prolongation of the time needed for bone healing as compared with similar cases treated by closed methods. . . . If fixation is not rigid, and if it does not provide against torsional, shearing and angular forces, absorption of bone about the fixation material will occur. When external immobilization of the extremity is added to the internal fixation of the fractures, these forces may be guarded against in part or almost in whole at the expense of functional activity of the part, with all its implications."

This article is a description of our further experiences with the method which has now been used in thirty cases, grouped as follows: humerus, two cases; shaft of the tibia, usually accompanied by fibular fracture, thirteen cases; unstable ankle fractures, four cases; fracture of both bones of the forearm with medullary fixation of both bones, four cases; fractures of both bones of the forearm with medullary fixation of the ulna alone, five cases and fracture of the shaft of the radius alone, two cases. We have also used the method for maintenance of length and to prevent angulation in onlay bone grafting of the radius and tibia. This report will not consider the details of the latter application. The technic of insertion of the stainless steel pins for that purpose is identical with that used for fresh fractures in the same bones.

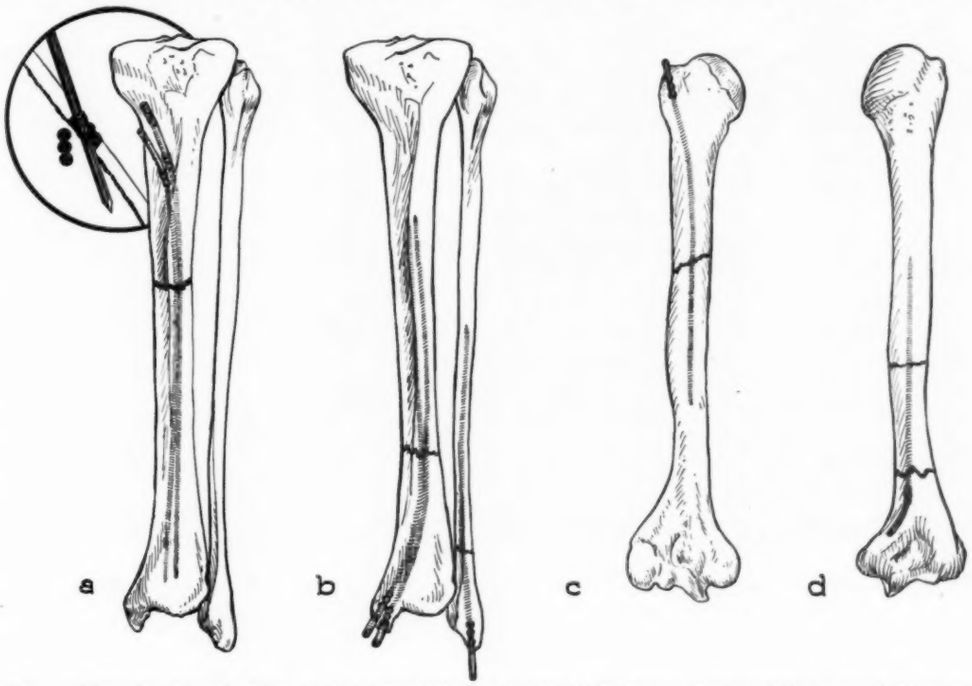


FIG. 1. Sites for introduction of the threaded pins in the tibia; inset shows triple linear drilling to make a slot in the anterior medial face of the upper tibia. The distal edge of this slot is undercut so as to allow introduction of the pin as parallel to the medullary canal as possible.

This method has not been used on any patient who in our judgment could have been effectively treated by closed manipulation and retention by plaster casts. It has been used chiefly in unstable fractures of the forearm and of the tibia in adults. However, in a few cases it has also been used in unstable forearm fractures in children, in fractures of the mid-shaft

region of the humerus which required open reduction and in unstable fractures of the ankle. With five exceptions all of our patients already had a period of trial of plaster fixation either by us or by other surgeons. The method is recommended as a substitute for internal fixation by plates and screws in some instances. In most cases external plaster fixation was used following medullary fixation for a variable period, usually about half the period ordinarily required for similar stable fractures of the corresponding bone that are amenable to treatment by plaster fixation alone. The advantages of the method are longitudinal and transverse stability in an anatomic position and early motion of the neighboring joints. When the larger sized pins ($\frac{5}{32}$ and $\frac{6}{32}$ inches) are used for medullary fixation of one or both bones of the forearm, plaster fixation can be dispensed with entirely, can be used for short periods of time, or can be used in the form of a removable splint. In the case of oblique fractures of the tibia transverse fixation near the fracture site by a short stainless steel screw of conventional type is also necessary.

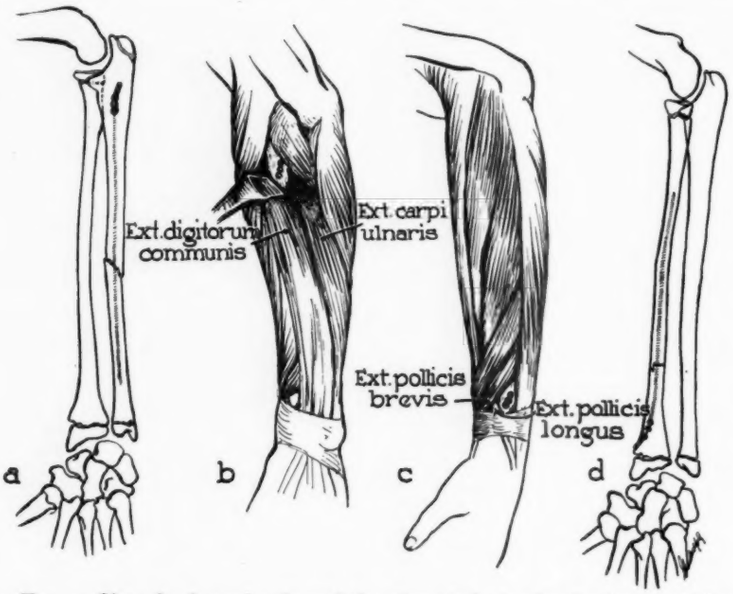


FIG. 2. Sites for introduction of the threaded pins in the bones of the upper extremity.

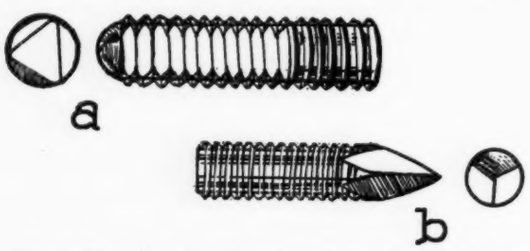
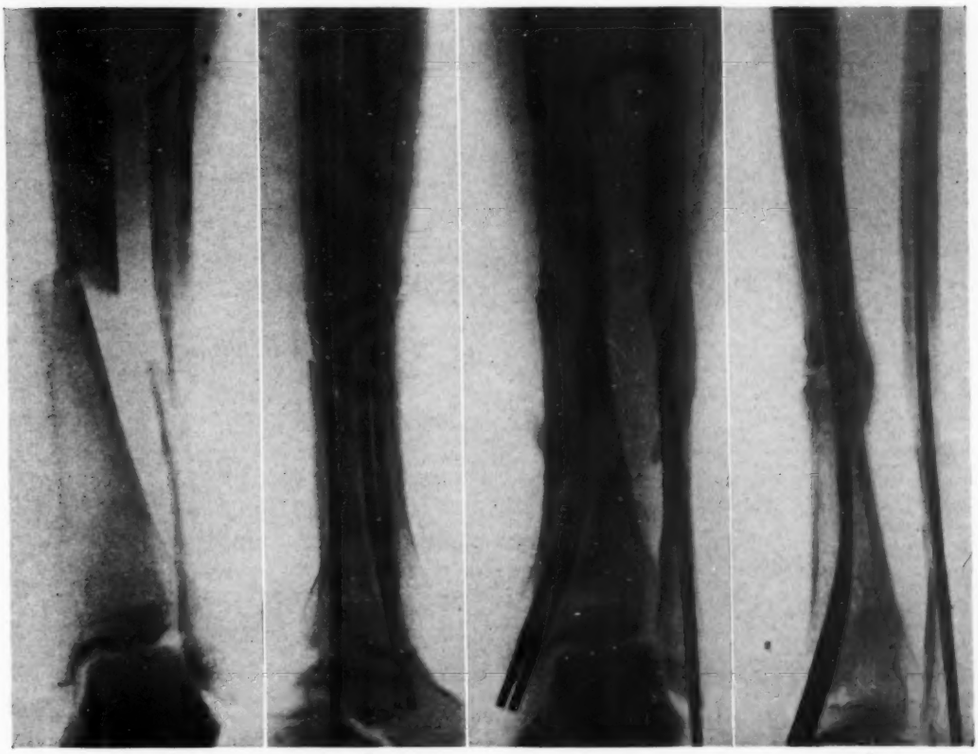


FIG. 3. Drawing showing tips of the threaded pins; (*a*), blunt, rounded pin tip. This type of tip is used in most insertions as the rounded tip will follow the cortical shell facing the medullary canal without engaging bone. Note the flattened sides to allow for firm grip by the Jacob's chuck; (*b*), sharp-pointed pins. This is the advancing tip of the pins introduced into the proximal fragment from the exposed fracture site in the proximal ulna and proximal humerus. The sharp point is required to penetrate the cortex at the end of the bone.

The surgical technic in placing the pins within the medullary canal requires scrupulous asepsis of the same type utilized in the open treatment of any fracture. Open visualization of the fracture site with anatomic reposition has been employed in all of the patients. This is also desirable in order to deal with small comminuted fragments and soft tissue interposition. We consider it dangerous to attempt the use of this type of fixation without exposure of the fracture site because of the damage that might be done to the soft tissues by



4a 4b 4c 4d

FIG. 4. *a*, anteroposterior film of transverse, slightly serrated fracture of the tibia and fibula at the junction of the middle and lower thirds prior to reduction; *b*, lateral film of the same case six weeks later on occasion of cast change. Fracture was immobilized with two 5/32-inch threaded pins through the medial malleolus and the medullary canal of the tibia and by a single pin through the lateral malleolus and fibula; *c*, anteroposterior film ten weeks after the fracture. At this time the patient was allowed ambulation without support. No motion was detectable at the fracture site at any time after the pins were inserted.

winding around the threads if the threaded fixation pin fails to enter the opposing fragment. The sites of introduction for the pins (Figs. 1, 2) are subsequently described in detail for each bone. In most instances these sites which are slightly different from those recommended for the insertion of Küntscher nails were decided from the results of many dissections and trials by one of us (A. A. S.) on cadavers and amputated limbs. No special apparatus is required for the insertion of the pins except a heavy duty drill equipped with a Jacobs or other type of tight-holding chuck. It is desirable to protect the skin on the side from which the pin is being inserted by a flat retractor. Several holes are drilled in the osseous cortex as shown in the insert of Figure 1.

The average periods for external auxiliary plaster support in adults were as follows: both bones of the forearm, two to eight weeks; humeral shaft, two to four weeks; tibial shaft, six to ten weeks; malleolar fractures, three to four weeks. In the shorter periods for external auxiliary plaster support for fracture of both bones of the forearm, the transverse introduction of a Kirschner wire or a slender, unthreaded steel pin through both radius and ulna[4] was also used in a few cases. The removal of the pin or pins in fractures of the radius and/or ulna and in fractures of the tibia was not carried out generally until one to four months after physical and roentgen signs of consolidation at the fracture site. The time of pin removal usually depended upon personal factors in connection with each patient. In about half the patients removal of the pin was done following local infiltra-

5a 5b 5c 5d

FIG. 5. *a*, anteroposterior film showing spiral fracture at approximately the junction of the middle and lower thirds of the tibia with slightly higher spiral fracture of the fibula; *b*, anteroposterior film showing the reduction with insertion of two 5/32-inch threaded flexible pins through the medial malleolus and a transverse-locking screw; *c*, lateral view on reduction; *d*, end result; same case after removal of fixation nine months later.

tion of procaine. In several instances when the pin was allowed to protrude from the olecranon, no anesthesia was required.

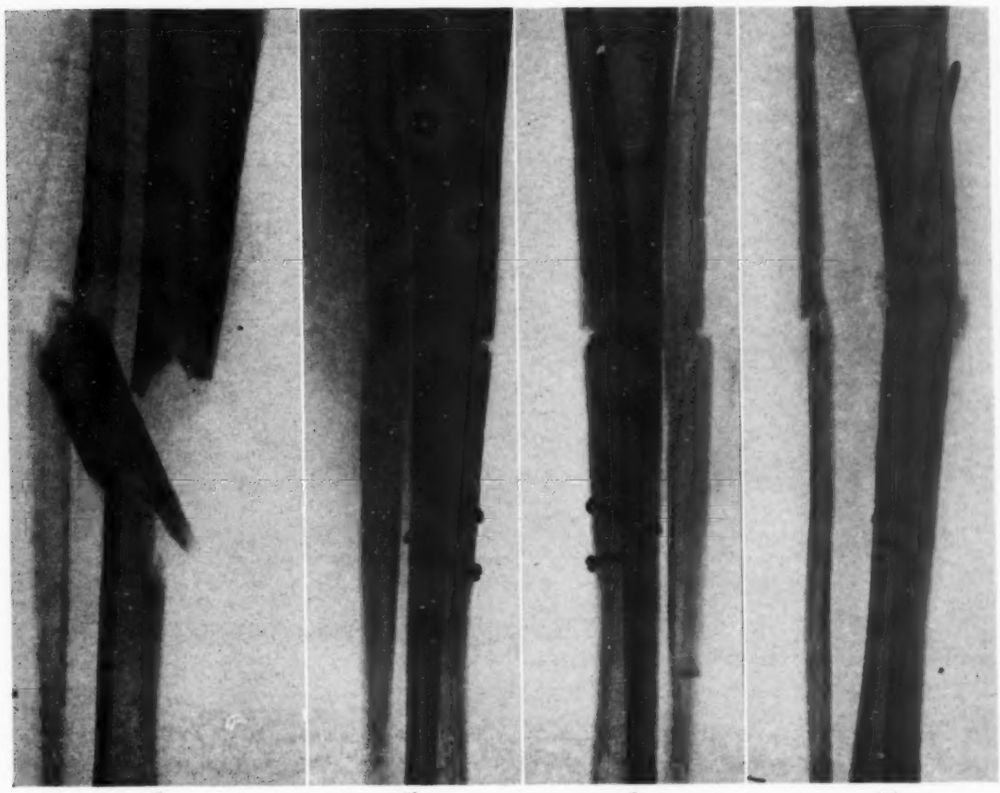
COMPOSITION AND DESCRIPTION OF THE PINS*

The material from which the pins were fabricated is a special 18–8 SMO (chromium-nickel-molybdenum) alloy steel with a Rockwell hardness number of not less than 30C or more than 35C. The composition is as follows: chromium, 17 to 20 per cent; nickel, 10 to 14 per cent; molybdenum, 2 to 4 per cent; manganese, 2 per cent maximum; silicon, 0.75 per cent maximum; carbon, 0.08 per cent maximum; phosphorus, 0.03 per cent maximum and sulfur, 0.03 per cent maximum.

The rods from which the threaded pins are manufactured must be drawn or rolled to obtain the required hardness. Heat cannot be used to form or shape the pins as the hardness of the alloy is destroyed and it becomes brittle. The diameters of the pins which we have used vary from 1/8 inch to 7/32 inch at intervals of 1/32 inch (4 diameters) and from 6 to 15 inches in length and are threaded in proportion to their diameters from twenty-four to forty-eight turns to the inch. The depth of the threads in each case is not sufficient to weaken the pins, being deeper in the case of the larger pins.

The pins used most frequently are 5/32 inch in diameter in various lengths. It is important that the ends of the pins be blunt and slightly rounded. (Fig. 3*a*.) Pointed and cutting edge pins cannot be used as they engage the inner surface of the osseous cortex and may drill out through this osseous barrier instead of sliding along its inner surface. This is particularly true of the malleolar insertions in the tibia and of insertions in the radius.

* The authors are indebted to Mr. M. W. Hill, General Manager, Zimmer Manufacturing Company, Warsaw, Ind., for the metallurgic data and the supply of pins manufactured to our specifications.



6a 6b 6c 6d

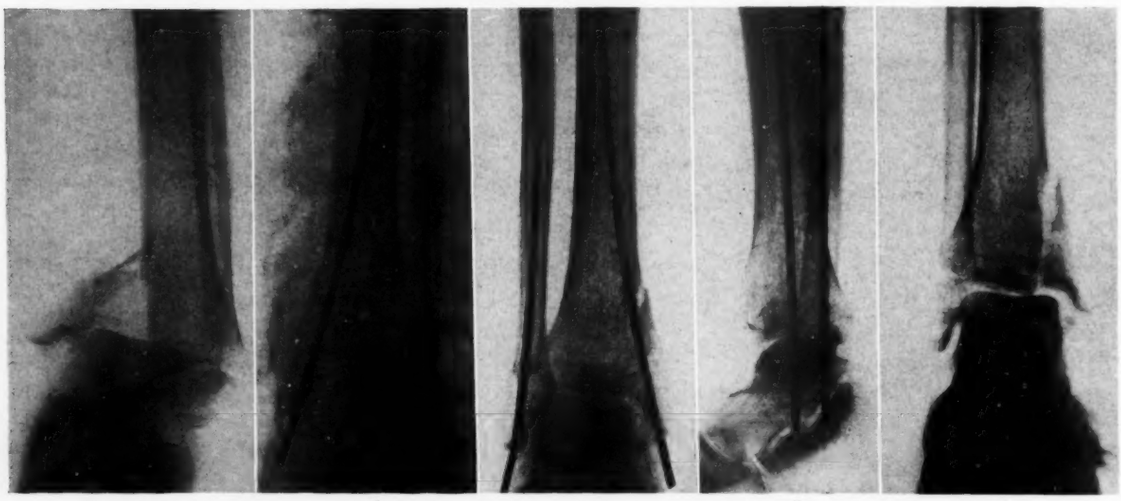
FIG. 6. *a*, lateral film of three-segment fracture of the tibia prior to reduction; *b*, lateral film same case on occasion of cast change nine weeks after reduction. Fixation was by means of two 5/32-inch threaded pins inserted in a distal direction through the medial face of the upper tibia. Two transverse-locking screws were used for the lower spiral fracture; *c*, lateral film same case on occasion of cast change sixteen weeks after fracture. At this time there was no motion detectable at either fracture site; *d*, anteroposterior film sixteen weeks after fracture.

As noted in the technic for the humerus and ulna it is necessary to use sharp, pointed pins when primary proximal insertion of the pin is at the fracture site with later reversal of the direction of the pin for introduction into the distal fragment. The ends are flattened on three or four sides for a distance of 1 inch so that the pins will engage the chuck without slipping when rotary force is applied. (Fig. 3*a*.)

SURGICAL TECHNICS FOR INDIVIDUAL BONES

Tibia and Fibula. The pins may be introduced from either a superior or an inferior site. The superior site is preferable in fractures of the upper three-fifths. The anteromedial face of the tibia is exposed at least 3 inches above the fracture line. At least three holes each vertically placed above the other are drilled in the cortex. This upper ledge is beveled as shown in the inset of Figure 1. The threaded pin is introduced by the drill until it emerges from the proximal fragment at the previously exposed fracture site.

The fracture is reduced and held with forceps while the threaded pin is introduced into the distal fragment. Penetration can be measured by comparison with a similar pin of the same length and the final position of the pin verified by roentgen films. If it is not possible to introduce the entire length of the pin selected, it is cut off with 1 inch protruding from the original site of introduction. If the correct angle of introduction has been secured, approximately 15 or 20 degrees, there should be no undue prominence of the pin when the skin is closed over it. It is not feasible to introduce pins of this type into the fibula from above.



7a 7b 7c 7d 7e

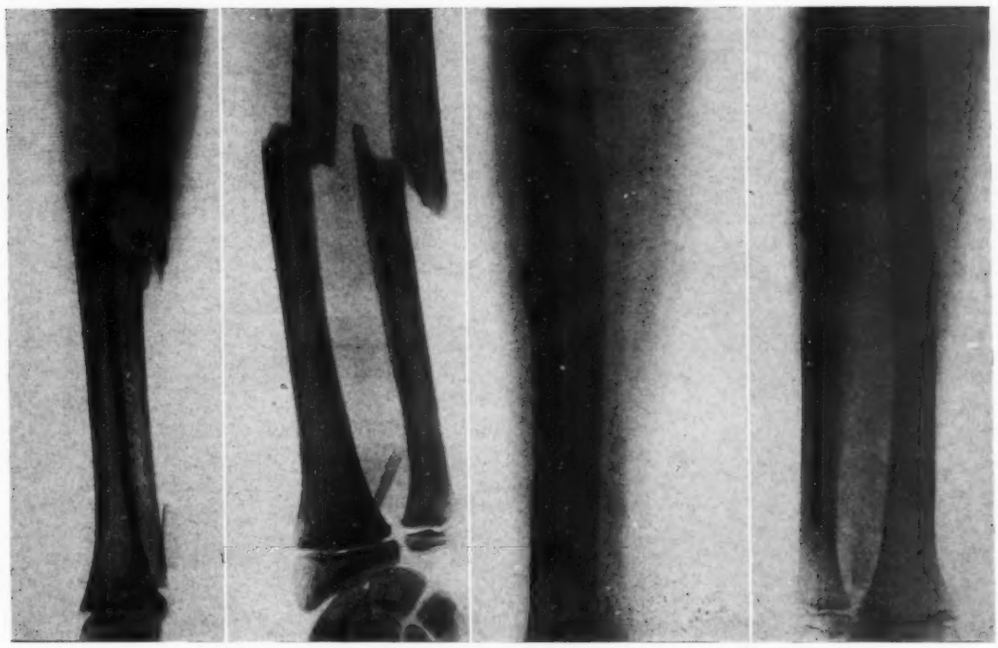
FIG. 7. *a*, anteroposterior film of an unstable, comminuted, bimalleolar fracture prior to reduction; *b*, anteroposterior film same case in plaster immediately following reduction. Fixation was secured with ⅛-inch threaded flexible pin. One pin was drilled upward through the medial malleolus and another through the lateral malleolus of the medullary canal of the fibula; *c*, anteroposterior film same case ten weeks after the injury showing solid osseous union with fixation still in place; *d*, lateral film taken at the same time as *c*; *e*, anteroposterior film taken eight months later following removal of the fixation.

When the inferior site of introduction of the pins is used, they are started on the inferior surface of the medial and lateral malleolus through a vertical incision in the ligaments. The fibular pin pursues a straight course. Introduction of the threaded pin into the tibial shaft through the medial malleolus requires the pin to adapt itself to the curve of the tibial cortex by following the medullary curve of the lateral cortex. No difficulty is experienced if the pins have rounded, blunt points. As the pin begins to conform to the lateral cortex of the tibia in its passage upward, an increased resistance to drilling is experienced by the operator and the assistant who is maintaining the reduction with bone-holding forceps at the fracture site above notes the transmitted vibration. If the vibration is not experienced by the assistant, the operator should pause and determine by physical or roentgen examination if the pin is still in the medullary canal. After 1 inch or more of ascent in a straight direction has been negotiated, less resistance to drilling is again noted. In the instance of pins introduced through the malleoli, approximately ¼ to ½ inch is allowed to protrude. This short length is usually well covered by the ligaments as they return to position. Pins larger in diameter than 5/32 inch cannot be inserted through the malleoli.

We have observed no instances of skin necrosis from pressure on the protruding ends of the pins by either of the technics described in this section. Roentgenograms illustrating the appearance of threaded pins introduced by each of these technics are shown in Figures 3 and 4.

According to Böhler the minimum diameter of the medullary canal of the tibia is 8 to 12 mm. This is at the junction of the middle and distal thirds. The marrow canal of the entire middle third is approximately the same diameter. (Figs. 4 to 7.)

Humerus. In the two cases that we have done the pin was introduced into the proximal fragment and then retrograde into the distal in one case and downward through the greater tuberosity in the other. Experimental introductions in cadavers have demonstrated the feasibility of introduction of the threaded pins from an inferior site. The narrowest portion of the medullary canal of the humerus is in the



8*a* 8*b*

FIG. 8. *a*, anteroposterior and lateral film showing an unstable fracture with overriding in the middle third of the radius and ulna in a boy of eleven years; *b*, anteroposterior and lateral roentgenographic films same case twelve weeks later showing solid osseous union of both bones. Note that internal fixation was secured by a $\frac{5}{32}$-inch threaded pin introduced through the marrow canal of the ulna only. The radius was stable and did not require internal fixation.

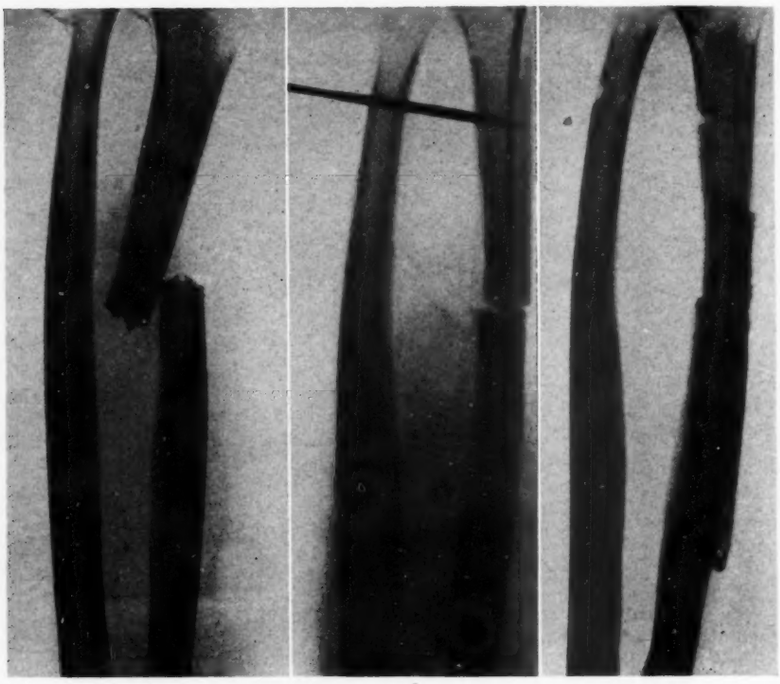
distal part of the shaft just proximal to the trochlear enlargement. Its internal diameter is 6 to 9 mm.

In introducing a pin through the fracture site into the proximal fragment with the expectancy of later reversing the direction of the pin the operator must use a pin with a sharp advancing point, so that penetration of the upper humerus can take place. The fracture is reduced and the direction of the pin reversed by an assistant who has attached a drill to the protruding end at the upper humerus.

For introduction of the pin through the greater humeral tuberosity a vertical 1½ inch muscle-splitting incision is made in the upper deltoid margin at the junction of its anterior and middle thirds. The pin is introduced through a hole drilled in the thin cortex of the greater humeral tuberosity.

For introduction of the pin in an upward direction from a site just above the elbow a 3-inch incision is made on the lateral end slightly posterior just above the elbow. A hole is drilled in an upward and slightly medial direction from just behind and above the point of junction of the epicondylar ridge and humeral shaft on the posterior surface. Care must be taken that penetration is completely into the medullary canal which will require a depth of drilling of at least 2 inches if the line of drilling conforms as nearly as possible to the long axis of the humerus. The osseous cortex of the humerus at this level is quite dense and a small starting drill hole is best placed in a direction vertical to the cortex and enlarged in the direction just described.

Ulna. Insertion of long, threaded stainless steel pins into the medullary canal of the two forearm bones will be considered separately as the problems involved are distinct. Retrograde insertion from the fracture site cannot be done in the radius because of the uncertainty of the site of emergence of the pin from the distal portion of this bone. Then, too, the radius presents a marked curve in its lower half while the curve of the ulna is less and



9a 9b 9c

FIG. 9. *a*, lateral roentgenographic film in mid-pronation-supination of fracture of the radius with overriding; *b*, similar film following introduction of medullary fixation with a ⅛-inch threaded wire introduced from the distal radius and a transverse-locking pin introduced across the interosseous membrane from the ulnar side; *c*, similar film five months after the injury after removal of the fixation.

present in both its distal and proximal fifths. The medullary canal of the radius is narrow in its middle three-fifths with the narrowest point about the center of the bone. The medullary canal of the entire distal three-fifths of the ulna is quite narrow. It should also be recalled that the curve of the ulna is in the horizontal plane and the axis of its medullary canal is straight as viewed in the coronal section. (Figs. 2 and 8.) The internal diameter of the medullary canal of the forearm bones varies from 2 to 5 mm. in adults (Böhler).

For retrograde insertions of the pins in the ulna they are drilled in a proximal direction into the proximal fragment from the fracture site. Similar to the comparable situation in the humerus a pin with a sharp point must be used so that it will penetrate the osseous cortex at the olecranon. When this occurs, an assistant mounts the emerged pin tip into another drill and continues the drilling in the same direction until the other point of the pin is even with the fracture site in the proximal fragment. The fracture is then reduced and the direction of the pin is reversed in inserting it into the distal fragment. In this technic a portion of the pin can be allowed to protrude through the skin wound in the ulna.

In order to avoid the latter and since it is mandatory in children to avoid penetration of the epiphyseal line, we prefer to introduce the ulnar pin from an obliquely placed drill hole 1 inch distal to the proximal epiphyseal line on the lateral surface of the upper ulna. Reflection of the proximal 1½ inches of the extensor digitorum communis and the extensor carpi ulnaris at their origin is required to expose this surface of the ulna. The rounded, blunt, pointed pin should be used in this technic. The pin is advanced in the distal direction until it is identified at the fracture line. The fracture is reduced and the pin

screwed in a continuing distal direction into the distal fragment; ½ to ¾ inch of the pin is allowed to protrude from its site of insertion. In this method the pin is entirely covered by muscle and skin when the wound is closed. (Fig. 8.)

Radius. A 2½ inch incision is made on the dorsal lateral margin to expose the distal portion of the radial shaft near the wrist. There is a small area on the dorsal and lateral margin of the radius approximately 1½ inches proximal to the distal articular surface which is uncovered by muscle or tendons. This space lies just distal to the distal margin of the curved distal surface of the muscle belly of extensor pollicis brevis. The distal portion of this space is bounded by the tendon of the extensor pollicis longus. Two or three vertically placed drill holes are made as shown in the insert of Figure 1. The direction of the drill is changed and it is advanced into the medullary canal in a proximal direction as parallel as possible to the direction of the medullary cavity. The threaded pin is screwed into the medullary canal of the radius, identified at the fracture site and continued into the proximal fragment after reduction. (Fig. 9.)

RESULTS

There have been no instances of nonunion and no infections. Solid union to physical examination was present in twelve weeks in all cases of fractures of the shafts of the forearm bones in adults with two exceptions. In one instance of rapid union of the radius, dense fibrous with partial osseous union of the ulna occurred. Residual tenderness did not disappear and complete roentgen consolidation was not secured until fifteen months after the fracture. However, this patient used the extremity without external support after the eighth week. The pins were removed five months after the fracture and normal joint motion, including a full range of pronation and supination, was observed six weeks prior to removal of the pins. A second case of isolated fracture of the radius at the junction of the middle and distal thirds required eighteen weeks for complete osseous union. In the four cases in which the method had been used for fracture of both bones of the forearm prior to closure of the epiphyseal line, union had been present in six to eight weeks in all instances. In these last cases insertion of the long, threaded pins into the ulna alone was carried out. Stabilization of the forearm following ulnar pinning was sufficient to maintain reduction of the radius. Circular plaster casts were also used as auxiliary support in all of these cases for six to eight weeks. Normal active and passive motion at all of the joints in the forearm, including normal pronation and supination, was secured in all patients with forearm fractures in four months or less with the exception of the isolated fracture of the radius with slightly prolonged time of union. This case required nine months to secure normal pronation and supination.

Osseous union by physical and roentgen examination was secured in the two fractures of the mid-shaft of the humerus, one case in nine weeks and the other in twelve weeks. Both of these patients reported to us during the latter part of the second week following fracture when a hanging cast had failed to secure reduction. There was no limitation of shoulder motion in either of these patients.

Solid osseous union was present in twelve weeks in all of the fractures of the shaft of the tibia with three exceptions, all cases in which there was comminution at the fracture site. Osseous union was present by twenty weeks in these latter three cases. Two of the patients demonstrating prompt union in twelve weeks presented double fracture lines with an intermediate free fragment. (Fig. 6.)

SUMMARY AND CONCLUSIONS

A new type of threaded stainless steel pin is described. Various sizes and lengths of this pin have been found to be applicable for medullary fixation of fractures of the shafts of the radius, ulna, humerus and

tibia, all bones in which medullary fixation by the Küntscher nail is not readily or satisfactorily done.

The technic of introduction of the long-threaded stainless steel pins is described in detail. The results are reported in thirty cases and roentgenograms of illustrative cases are included.

The method allows early motion at neighboring joints, maintains anatomic reduction and requires only a minimum of auxiliary external plaster support. We have used the method only in unstable fractures which in our opinion required open reduction. There have been no infections or non-unions. Delayed union was observed in the ulna in a single case of double fracture of the forearm bones in an adult. This was unaccompanied with disability beyond twelve weeks and was characterized only by slight residual tenderness at the fracture site on examination and by slow roentgen consolidation, a phenomenon seen with regularity when early consolidation of the radius occurs in both bone fractures of the forearm in adults.

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Adenosis is a hyperplasia of the breast in which larger and more numerous lobules are formed as in early pregnancy. Recent studies indicate that probably adenosis never becomes adenocarcinoma. However, intraductal hyperplasia of the breast, in which the ducts and smaller lobular structures become completely or partially filled up with cellular hyperplasia, is definitely a precancerous condition. This is the proliferative process known as epitheliosis; and when it becomes malignant, it is a type of epithelioma. The ordinary blue-dome cyst is now acknowledged as not precancerous but the fatty cyst (enclosing masses of degenerating foamy-like cells), although usually terminating in a benign, atrophic condition, may occasionally lead to malignancy. Apparently, when existent for a long time these foamy cells stimulate the still viable epithelial cells lining the entrapped ducts to abnormal hyperplasia which eventually spells cancer. Apparently, the actual presence of this fatty débris within the mammary ducts is necessary before this unusual process of epitheliosis and eventual malignancy can take place. (*Richard A. Leonardo, M.D.*)

INTRASPINAL SEGMENTAL ALCOHOL BLOCK FOR RELIEF OF INTRACTABLE PAIN*

A PRELIMINARY REPORT

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IN the past when intraspinal alcohol had been injected, the difficulties encountered were due, in large measure, to the amount of alcohol injected and also to the haphazard manner in which it was used. Alcohol in the amounts of ½ cc. to 1½ cc. has been used repeatedly[1–15] usually in the lumbar region and occasionally higher, for the obtundation of severe pain such as those of cancer origin.

The "one-shot" method has always been reserved by the writer for patients who had malignant disease because of the hazards of irreparable damage to vital centers. Sphincter involvements and paralysis were all too common and in an occasional case resulted in motor paralysis of the lower extremities. In cancer patients whose life span is short complications of these kinds are not too serious but should be avoided if possible. The injection of alcohol above the first lumbar segment or in the thoracic or cervical region had been employed only occasionally because of the obvious danger of injury to the cord by the needle point or producing a transverse lesion by the alcohol. It became apparent, therefore, that intractable pain could not, with any certainty, be relieved by the "one-shot" alcohol method and those patients whose pains were greater than that which morphine could control were subjected to rhizotomy,[16] anterolateral cordotomy[17–24] or frontal leukotomy,[25–30] or resection of appropriate areas of the sensory cortex.[32] Thus it is obvious that a method for neurolysis in the subarachnoid space which would insure accuracy of alcohol placement and safety in regard to possibilities of cord or nerve root damage would be desirable. For this purpose the intraspinal segmental method was developed.

PROCEDURE

The necessary equipment is assembled (Fig. 1) and the area of pain is determined by physical and neurologic examination of the patient as well as from x-ray findings. The area may be of any height in the cervical, thoracic or lumbar region. When the nerves subserving the pain are determined by accurate neurologic examination, a Tuohy catheter[33] with a stylet in place is passed through a Huber-point needle in the lumbar spine and advanced cephalad to the desired height.[34] (Fig. 2.)

The catheter is first measured on the patient's back before placement of the needle to decide the length of the catheter necessary to reach the height; i.e., if the location of the affected nerve is C-6, the catheter is placed on the patient's vertebral column on top of the skin at a point touching C-6 and the other end of the catheter extending down to the site of the lumbar puncture. The length is determined (usually about 30 cm.) and 10 more cm. are added (length of needle). Then the catheter is inserted through the needle to a distance of 40 cm. Occasionally paresthesias develop while the catheter is advancing but these are not serious. With the stylet still in place an anteroposterior x-ray is taken to determine accurately whether the catheter is at the desired level. (Fig. 3A.) On viewing the x-ray and noting the position of the catheter the measurements of the vertebral bodies are taken on

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the x-ray film to determine the amount of catheter to be withdrawn preceding each injection. (Nine per cent of the catheter withdrawn is deducted to allow for X-ray spread.) Thus if the distance between C-5 and C-6 is 3 cm., the catheter is withdrawn 3 cm. minus 9 per cent after the first injection and placed next to the C-6 intervertebral foramen at which point the posterior spinal sensory ganglion lies. Similar measurements are made for each segment to be treated. Before making the first injection the stylet is withdrawn and a quantity of alcohol necessary to fill the catheter is injected into it. The capacity of the catheter is usually 4 m of alcohol. After 4 m have been injected, anything following that amount will be deposited in the subarachnoid space. With the patient lying on the side (affected side uppermost) ½ to 1 m absolute alcohol is deposited at each segment. Five or six segments may be treated in one procedure. If the condition is bilateral, the opposite side may be treated after an interval of several days.

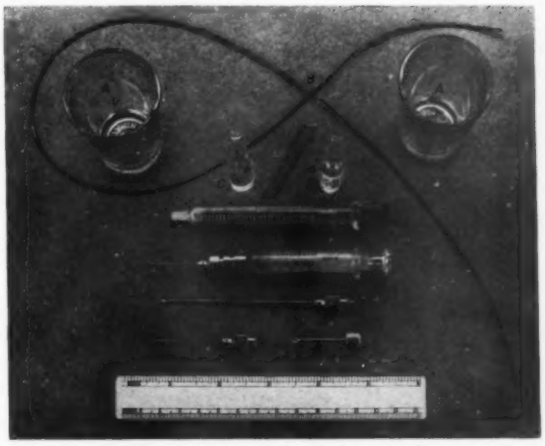
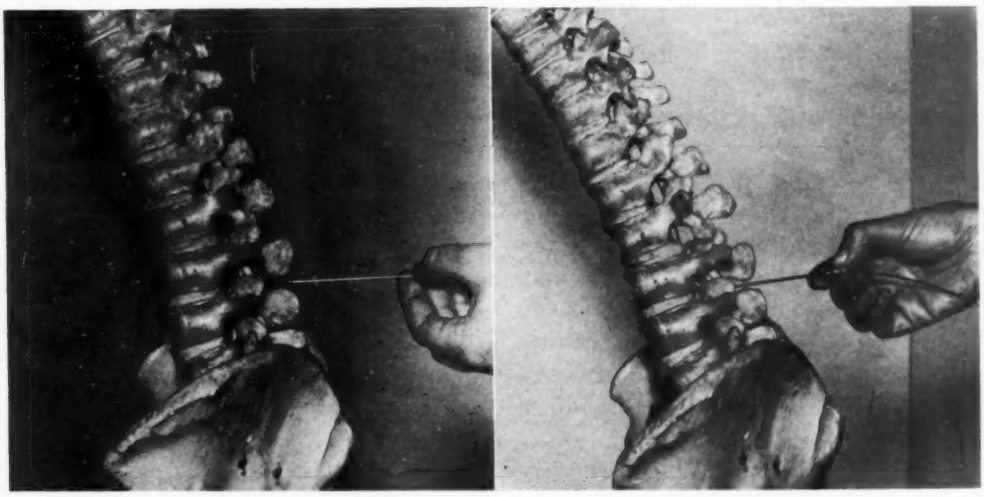


FIG. 1. Equipment used in intraspinal segmental alcohol block. A, two medicine glasses, one used for novocain (in skin wheal) and one for alcohol; B, 3.5 mm. Touhy catheter with stylet in place; C, 1 per cent novocain for skin and spinal ligaments anesthesia; D, ampule of absolute alcohol; E, tuberculin syringe; F, syringe for use in making skin wheal; G, No. 16 gauge Huber point needle; H, 23 gauge needle for use in tuberculin syringe for alcohol injection; this size fits lumen of catheter tightly; K, spinawl for puncturing skin and ligaments before inserting Huber needle and L, 15 cm. ruler.



2A 2B

FIG. 2. A, Huber point needle at interspace in lumbar region of skeleton; B, catheter threaded through needle and advancing cephalad to the desired height.

A total of twenty patients have been treated as follows: five cases of carcinoma of the lung with spinal metastasis and nerve compression, three cases of severe post-herpes zoster pain in thoracic region, two cases of acute protracted sciatica due to osteoarthritis of the spine, one case of metastatic carcinoma of the lymph glands of the axilla, one case of carcinoma of the penis with metastasis to the inguinal glands, one case of recurrent carcinoma of the bowel with perineal metastasis, two cases of carcinoma of cervix with spinal metastasis, two cases of carcinoma of the

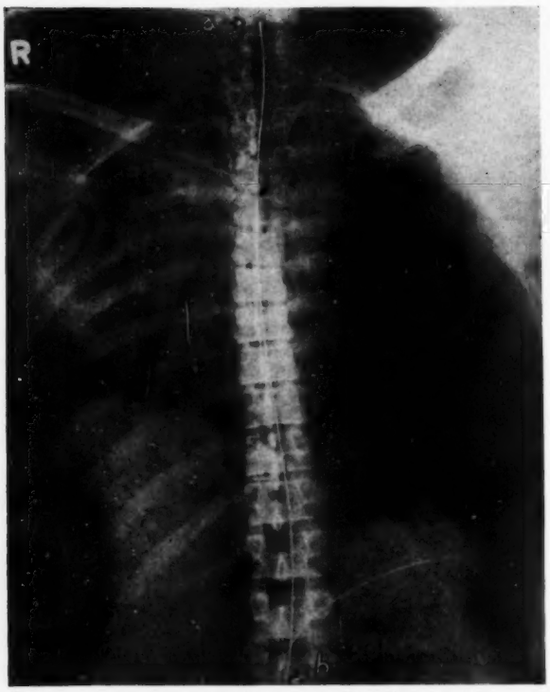


FIG. 3. A, anteroposterior x-ray showing catheter in place in the subarachnoid space; *a*, tip of catheter at height of C-6 vertebra; *b*, entrance of catheter at L-2 vertebra.

prostate with spinal metastasis and nerve root compression and three cases of intermittent claudication of peripheral vascular origin.

Results have been uniformly good in 75 per cent of the patients. There has been good sensory analgesia without any evidence of motor involvement. There were no evidences of any sphincter damage. In the 25 per cent not helped by the procedure there was no evidence of any motor difficulties. The subjective relief of pain has been excellent.

The following case report is illustrative of the procedure used in the cervicothoracic region.

CASE REPORT

R. B., a thirty-nine year old negress, was admitted to the hospital on May 5, 1949. She had been operated upon in March, 1949, and a hysterectomy was done for profuse menorrhagia. The pathologic report was sarcoma. She was asymptomatic in December, 1948. Then she had pneumonia characterized by pain in the right apex and by fever. The fever responded to treatment but the pain in the right apex persisted and radiated to the right shoulder and down the arm. The pain was described as severe in character and required frequent opiates to produce rest.

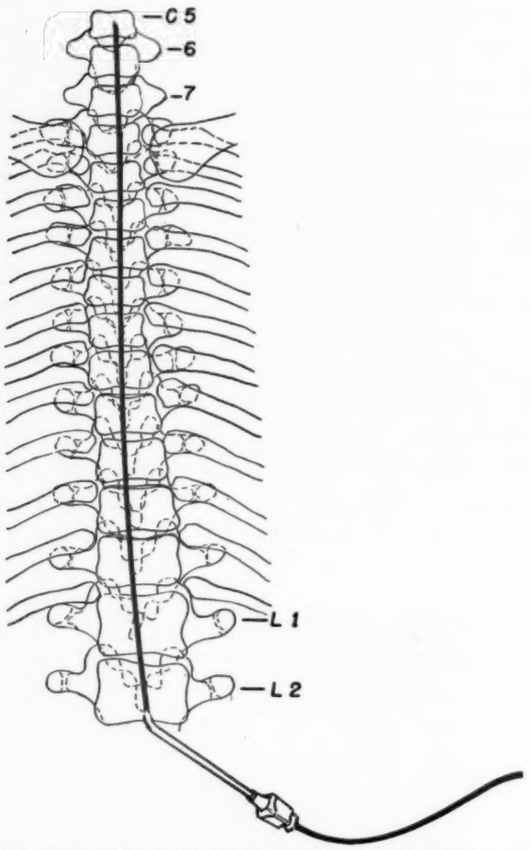


FIG. 3. B, schematic drawing of vertebral column depicting catheter entering at L-2-3 interspace and advancing to C-5 vertebra.

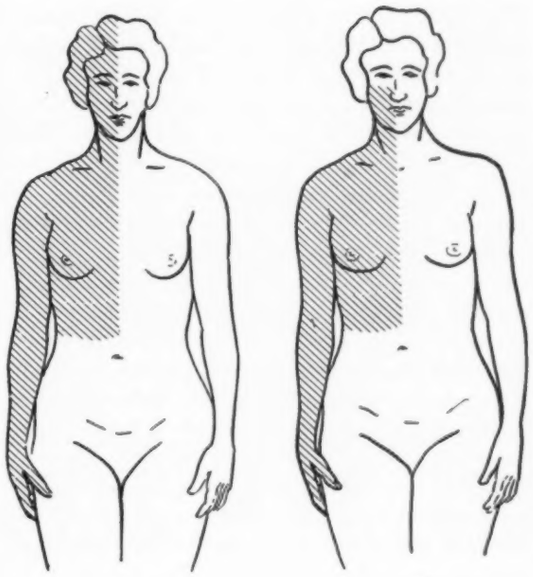
On examination chest wall was symmetrical, with slight limitation of respiratory excursions on the right. There was impaired resonance over the right upper lung field, anterior and posterior, with diminished breath sounds. Examination of the heart was negative and the blood pressure was 95/50. Over the right shoulder there was moderate tenderness on motion of the right arm and shoulder girdle. X-ray report stated, "Occupying practically the entire lung field is a huge area of density obliterating all the pulmonary details." Anesthesia consultation was requested and examination revealed that the complaint of severe pain in the right shoulder and arm was the result of a large metastatic tumor in the right lung which has been compressing nerve roots. The patient

also complained of pains in the upper anterior chest wall.

The procedure for intraspinal segmental alcohol block was performed. The catheter was advanced from a lumbar puncture needle cephalad to the height of the sixth cervical vertebra. (Fig. 3B.)

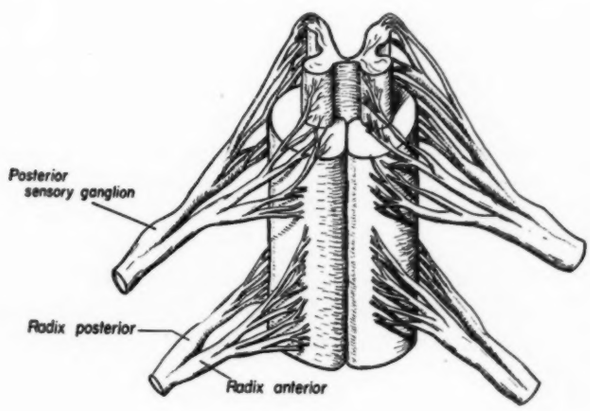
This position was checked by x-ray. One m of alcohol was injected at this level. The catheter was withdrawn 2.5 cm. to C-7 interspace and 1 m injected here. The catheter was withdrawn to D-1 interspace (2.5 cm.) and another minim of alcohol injected here. Finally the catheter was brought to D-2 (3 cm.) and 1 m alcohol injected. The patient was lying on the left side throughout the procedure, affected side uppermost.

Immediately following the procedure the patient was insensitive to pinprick on the side of the head from the sagittal suture downward to the mandible on the right side. (Fig. 4A.) The right side of the neck was also insensitive, as was the thoracic wall, anterior and posterior, from D-1 to D-9. The right, upper extremity in its entirety was also insensitive to pinprick.



4A 4B

FIG. 4. A, shaded area depicts extent of skin analgesia immediately following block; B, two days later area of analgesia had receded to height of zygomatic arch. There was no impairment of motor power; patient had strong hand grip and fed herself without trouble. There was slight loss of position sense.



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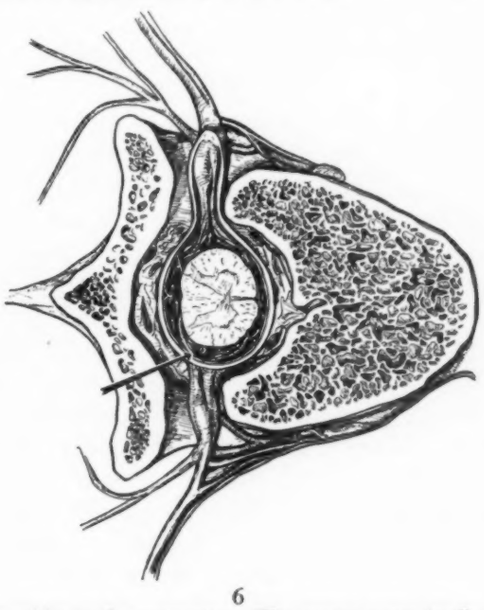

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FIG. 5. Spinal cord in thoracic region showing its division into white and gray matter. The motor roots (radix anterior) contain the efferent fibers and are smaller in size than the sensory (afferent) roots (radix posterior) which contain the posterior sensory ganglia. All these structures are contained within the arachnoid, hence surrounded by spinal fluid (See Figure 6) and may be affected by the alcohol. (Redrawn from Spalteholz Hand Atlas of Human Anatomy, J. B. Lippincott Co., Philadelphia and London.)

FIG. 6. Cross section of spine in upper thoracic region. The end of the catheter is shown (large arrow) and the path of the alcohol injected through the catheter (small arrows). The patient is lying on the left side with the affected (right) side uppermost and alcohol is rising to the top of the spinal fluid level at which point it exerts its effect usually on the larger posterior root. (Redrawn from Spalteholz Hand Atlas of Human Anatomy, J. B. Lippincott Co., Philadelphia and London.)

The patient immediately lost all the pain in her arm and shoulder and they could be moved in any direction without pain. There was no motor loss either in the upper or the lower extremity. No Horner's syndrome developed although the right arm was 3 degrees warmer than the left. Examination two days later showed that the area of analgesia had diminished to the height of the zygomatic process (Fig. 4B) but continued throughout the other regions previously described. There was no evidence of motor involvement. The patient was able to eat her meals unaided, had equal strength in her hand when compared with the opposite and the biceps and triceps reflexes were present.

There was slight derangement of the proprioceptive function. There was no evidence of any sphincter involvement at any time throughout her whole stay in the hospital. The patient had a moderately severe postspinal headache which lasted two or three days. She was out of bed the next day and was walking about the ward completely free of pain. The pain-free status of the patient had persisted for over two months. She has no complaints of pain whatever.

COMMENT

It is well known that anesthetic drugs injected into the subarachnoid space primarily affect the posterior sensory roots. (Figs. 5 and 6.) The anterior motor roots are affected less and the rami communicantes the least. It is on account of these phenomena that spinal anesthesia for surgery is possible. Alcohol has a great affinity for nerve tissue and is taken up by it readily. If the amount of alcohol is large, we may expect motor as well as sensory changes; but if the amount is minimal, sensory changes alone are more likely to occur. Also, there is a greater amount of nerve tissue in the posterior sensory root which renders more likely the absorption of small amounts of alcohol by this root rather than the anterior root. The decreased specific gravity of 95 per cent alcohol (0.816) in relation to spinal fluid (1.003 to 1.007) causes the alcohol to rise in the subarachnoid space to the top of the fluid level. At this point it instantly goes into action destroying the nerve fibers by a process of chemical destruction of the axis cylinder which renders the conductive ability of the fiber to transmit impulses, decreased or void, according to the amount of destruction resulting from the concentration and volume of the alcohol injected.

The maximum amount of alcohol used in this series (1 m at each segment) apparently is sufficient to affect the sensory roots only. A maximum of six segments are injected at one time. Hence less than ½ cc. of alcohol is injected at one procedure and this amount is placed at various segments extending a distance of 10 to 12 cm. Keeping within these dosage limits will apparently prevent harmful effects.

SUMMARY

A method is suggested for relieving intractable pain due to cancer or other conditions by a simple procedure which accurately places a minimal amount of alcohol at the posterior root ganglion. There do not appear to be any harmful effects from the procedure. It may be useful also in peripheral vascular diseases of the lower extremity in which pain and vasospasm are factors without harmful complications.[35] In one case of osteoarthritis of the spine in which ½ m. of alcohol was used at D-12 and L-1, 2 and 3, there was not only relief of pain but also a hot, dry extremity indicating sympathetic paralysis on this side. The increase in skin temperature was 4 degrees over that of the opposite foot. This sympathetic paralysis persisted for over a month.

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POSTOPERATIVE ABDOMINAL WOUND SEPARATION AND EVISCERATION

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NEWER knowledge of nutrition, infection, shock, pulmonary complications, phlebitis and wound healing which has been added to the doctor's armamentarium during the past ten years has definitely reduced morbidity and mortality in surgery. Many of us have been slow in applying this information to the problem of wound healing generally and evisceration in particular.

In the laparotomized patient many factors influence the behavior of the wound. As Downs has pointed out, there are four factors to be considered in the healing of wounds: first, the patient; second, the wound; third, the suture materials and fourth, the technic. Of these the patient is of paramount importance. Healthy tissues heal in healthy people. Chronic diseases diminish the urge to heal. Varco emphasizes the importance of restoring these patients to as normal a state as possible before surgery, thus not only reducing the operative hazard but also making it possible for the wounds to heal at a more normal rate.

As Howes classifies the healing of wounds, the first or lag period is characterized by inflammation and exudation and lasts four or five days. The regenerative phase is characterized by fibroplasia. Ogilvie has shown that the wound loses tensile strength during the lag period. The strength of a well sutured wound is 40 per cent of that of the uncut tissues. Where absorbable suture is used, the tensile strength drops from 20 to 25 per cent of the original by the fourth postoperative day. Fibroplasia begins on the fifth day and by the sixth day the wound has regained 50 per cent. By the tenth day 90 per cent of its normal strength has been regained.

Abbott points out that protein synthesis occurs at the site of wound healing, that this process is dependent upon available amino acids and that if the patient is in a state of negative nitrogen balance, wound disruption may result. Thompson, Ravdin and Frank found that a high percentage of dogs with well advanced hypoproteinemia suffered wound breakdown and evisceration following laparotomy. Blood protein determination aids in estimating the state of the patient. However, as Abbott has shown, it is not a true index of nitrogen metabolism since it does not indicate the degree of depletion that has occurred in the body reservoir. This can probably be better estimated by such clinical manifestations as weight loss. Clarke and Arcy have demonstrated that a high protein diet actually decreases the lag period and accelerates fibroblastic activity. A relationship between adequate nutrition and local tissue immunity is indicated by the work of Cannon.

Patients with fevers, fistulas, diarrhea and obstructions are prone to dehydration. Coller and Maddock have shown that the insensible fluid loss is increased in fever so that a patient with a temperature of 102°F. loses a minimum of 2,000 cc. daily. The surgeon must be aware of this added fluid loss lest dehydration occur which, as Whipple has emphasized, prolongs the lag period of wound healing.

Holman found that a vitamin C deficient diet retards wound healing in approximately one-half of the patients studied. Hunt showed that vitamin C deficiency is particularly prevalent in gastrointestinal cases. Vitamin C reserves in the tissues, not the blood plasma level, are the determining factors in wound healing according to Lund and Crandon. Vitamin C satura-

tion can be produced by the administration of 1,000 mg. of ascorbic acid daily for three days and maintained on 100 mg. daily.

Besser and Ehrenhoft have demonstrated that chronic anemia as part of a generalized nutritional deficiency is an important factor in wound healing but that the acute anemia from blood loss is not.

Adequately nourished patients are capable of normal regeneration of tissue. Under the influence of increased protein feeding the body is able to shorten the lag period but, as emphasized by Howes, the surgeon can do nothing by topical application to shorten this period or hasten the onset of fibroplasia. If he will concentrate on removing the inhibitors of wound regeneration, the rate of healing will be satisfactory.

McGregor suggests that incisions of the abdominal wall must give ready access to the parts under investigation but must not weaken the abdominal wall. Wounds anatomically placed heal more soundly than those in which the physiologic principles of abdominal wall function are ignored. Singleton believes that properly placed anatomic incisions may eliminate disruption and hernia. Hartzell indicates that wound disruption is essentially a complication of the vertical incision.

Howes studied the comparative effects of silk and catgut in the experimental wound and found that those sutured with catgut presented a more intense and prolonged exudative phase than those in which silk was used. Localio noted a greater inflammatory reaction, a prolongation of the lag period and a delay in the onset of fibroplasia in the catgut-sutured wounds as compared with those sutured with nonabsorbable materials.

The technic of closure influences the healing of wounds. Localio observes that numerous islands of necrosis occur when the surgeon traumatizes or devitalizes tissue by rough handling, mass ligation, undue retraction, crushing tissues with large instruments or forceful blunt dissection. The necrotic tissue must be destroyed, heightening the inflammatory reaction, prolonging the first period and delaying the second period of wound healing. Caldwell has aptly observed that in surgery meticulous, gentle methods are far more important than speed.

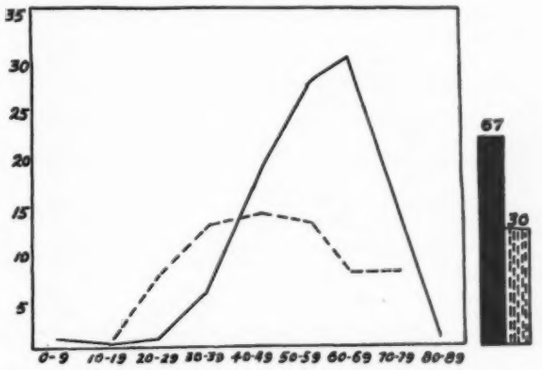

FIG. 1. Distribution of the cases of evisceration as to age and sex. Figures on ordinate represent number of eviscerations; those on abscissa the age of patients. The broken line in graph shows the number of eviscerations in females; the unbroken line, the number of eviscerations in males.

During the past ten-year, fiscal period (July 1, 1936 to July 1, 1946) 39,574 laparotomies were performed at the Los Angeles County General Hospital. In this group of patients ninety-seven eviscerations occurred, an incidence of 0.245 per cent, which compares favorably with the 0.2 to 2.0 per cent incidence reported in the literature. In a similar survey at the Los Angeles County General Hospital covering the preceding eight-year period Totten noted an identical incidence of evisceration, 0.24 per cent.

In our series there were thirty eviscerations in females and sixty-seven in males. (Fig. 1.) The highest frequency in our female patients occurred between the ages of forty and forty-nine while in the male the peak incidence was from sixty to sixty-nine. Forty-four of the ninety-seven eviscerations occurred during May, June, July and August. This differs from most reported series in which the peak incidence occurred during the winter months.

Primary and associated diseases that influence the nutritional state of the patient contribute to faulty wound healing. (Table

1.) Weight was mentioned in sixty-five of the ninety-seven cases. There was a definite weight loss in forty-two, many showing a rapid rate of loss. Of the twenty-seven cases of carcinoma, twenty-four had definite weight loss.

TABLE I
PREOPERATIVE CONDITIONS AS THEY RELATE TO EVISCERATION

No. of Cases	Condition	Percentage
42	Catabolic state	43.3
27	Carcinoma	27.8
15	Deficiency states	15.4
14	Peritonitis	14.4
12	Respiratory diseases	12.3

In our survey there were fifteen cases with an associated clinical diagnosis of avitaminosis, none of which had vitamin C laboratory studies.

At the time of surgery wounds in twenty-seven of the ninety-seven cases were considered infected, fourteen patients had peritonitis. In twenty-one of the infected cases drainage was done through stab wounds lateral to the main incision. In eviscerations occurring after the tenth day infection was considered the dominant factor.

TABLE II
SURGERY OF ORGAN OR SYSTEM IN RELATION TO EVISCERATION

No. of Patients Operated Upon	Organ or System	Eviscerations	Percentage
39,574	All	97	.24
572	Colon	17	2.96
1,907	Stomach or duodenum	26	1.36
1,875	Biliary tract	24	1.30
8,634	Pelvic organs	9	.143
8,321	Appendix	7	.084

Twelve patients suffered from some form of associated respiratory disease, all characterized by cough.

There were 572 operations performed for lesions of the colon with seventeen eviscerations, an incidence twelve times the general average. (Table II.) Surgery performed on the stomach and duodenum and on the biliary tract showed a similar occurrence of five and a half times the general average. Of 8,634 pelvic operations, nine eviscerated, an incidence of 0.143 per cent There were seven eviscerations in 8,321 appendectomies.

TABLE III
IMPORTANT PRE-EVISCERATION LABORATORY FINDINGS

No. of Cases	Procedure	Percentage
35	Total proteins	36.0
20	Below normal	57.2
15	Normal	42.8
69	Hemoglobin	71.1
46	70 to 100%	66.6
13	50 to 70%	18.8
10	30 to 50%	14.5
47	Red cell count	48.4
32	4 million or more	68.0
13	3 to 4 million	27.6
2	2.5 to 3 million	4.2
25	Prothrombin	25.7
16	Normal	64.0
8	50 to 80% normal	32.0
1	Below 50% normal	4.0

Twenty of the thirty-five total serum protein determinations were below the normal value of 6.4 Gm. per cent. (Table III.) The hemoglobin values ranged from 70 to 100 per cent in forty-six of the sixty-nine cases determined. Red cell counts were made in forty-seven cases; thirty-two had figures over 4 million. Prothrombin values were estimated in twenty-five individuals; sixteen had normal values and nine were below normal.

More than one-half of the ninety-two vertical incisions were in the upper abdomen. (Table IV.) It is significant that only one transverse, one subcostal and one McBurney incision eviscerated during the entire period of this survey. Again let it be emphasized that postoperative evisceration is essentially a complication of the vertical incision.

Various types of suture material were used. (Table V.) Catgut was employed

throughout in forty-five wounds which eviscerated, with dermal in fifteen, with silk in nine, with cotton in three and with steel alloy in two. Steel alloy was used throughout in five and cotton and silk each throughout in three. Thus it is readily seen that no suture material, either absorbable or non-absorbable, is immune to evisceration.

TABLE IV
INCISIONS

Number	Type	Percentage
92	Vertical	96.8
50	Upper abdominal	52.6
28	Lower abdominal	29.4
14	Mid-abdominal	14.7
3	Transverse or oblique	3.2
1	Transverse, upper abdominal	1.0
1	Subcostal	1.0
1	McBurney	1.0
2 No mention		

TABLE V
SUTURE MATERIALS, PERITONEUM AND FASCIA, NOT SKIN

No. of Cases	Type of Suture	Percentage
45	Gut throughout	50.5
15	Gut plus dermal	16.8
9	Gut plus silk	10.1
5	Steel alloy	5.6
3	Gut plus cotton	3.3
3	Cotton throughout	3.3
3	Silk throughout	3.3
2	Gut plus steel	2.2
2	Dermal	2.2
1	Silver wire	1.1
1	Gut plus silk plus dermal	1.1
8 No mention		

TABLE VI
TYPE CLOSURE

No. of Cases	Closure	Percentage
61	Layer	68.4
18	Layer plus tension	20.2
9	Through-and-through	10.1
1	Partial	1.1
8 No mention		

Different methods of closing the operative wound were used. (Table VI.) Layer closure was employed in sixty-one that eviscerated, layer closure plus tension sutures were used in eighteen and in nine cases through-and-through closures were employed.

TABLE VII
IMPORTANT CLINICAL PRE-EVISCERATION SYMPTOMS

No. of Cases	Symptom	Percentage Incidence
57	Retching and emesis	58.7
55	Distention	56.7
55	Fever (102°F. or above)	56.7
51	Bloody discharge from wound	52.6
46	Cough	47.4
32	Peristalsis (absent or diminished)	32.9

TABLE VIII
DAY OF EVISCERATION

No. of Cases	Day	Percentage
6	1–4	6.2
84	5–10	86.6
7	11–18	7.2

Postoperatively, more than one-half of these patients exhibited symptoms of retching and emesis, distention, bloody discharge from the wound and an excessive febrile reaction; cough was a distressing symptom in a little less than half. (Table VII.) In one-third peristalsis was reported as diminished or absent; 10 per cent of patients thought that the wound had "given way."

Evisceration occurred from the second to the eighteenth postoperative day. (Table VIII.) In the six cases noted between the first and fourth days some form of violence occurred. Eighty-four eviscerations occurred from the fifth to tenth postoperative days and seven from the eleventh to eighteenth. In each of the seven cases wound infection played a dominant role in the etiology.

Three methods of treatment were employed in resecuring the wounds, i.e., strapping alone, strapping with delayed suture, and immediate suture. (Table IX.) Strapping alone was used in four cases, resulting in three incisional hernias and one death.

TABLE IX
TREATMENT AND RESULTS

No. of Cases	Method of Closure	Percentage
4	Strapping	4.1
	End result	
3	Hernia	75.0
1	Death	25.0
16	Strapped with delayed suturing	16.4
	End result	
8	Well healed	50.0
6	Death	37.5
2	Hernia	12.5
77	Immediate suturing	79.5
	End result	
35	Death	45.4
28	Well healed	37.6
8	Hernia	10.4
6	No mention	7.8

Sixteen patients were treated with strapping and delayed suturing; of these eight healed well, six died and 2 developed incisional hernias. Immediate suturing in seventy-seven cases resulted in thirty-five deaths, twenty-eight well healed incisions and eight hernias. No follow-up was possible in six cases. In all there were forty-two deaths, a mortality rate of 43.8 per cent. Many of these patients were desperately ill from their primary disease but it seems reasonable to assume, as Hartzell had pointed out, that the evisceration was an important factor in at least one-half of the cases.

SURGICAL MANAGEMENT

One aim of the surgeon is to keep out of trouble. He has been successful in reducing the number and severity of such complications as postoperative pneumonia, peritonitis and shock but he has not been so successful in dealing with wound separation and disruption as shown by a comparison of our figures with those of Totten. To reduce the incidence of this complication he must practice prophylaxis. To lower his mortality rate he must improve the management by practicing the following suggestions:

1. Whenever possible correct nutritional deficiencies before surgery. The tendency to weight loss should be reversed and the obese should be reduced.

2. Restore normal fluid balance in dehydrated patients

3. Chronic anemia as part of a general depletion should be overcome.

4. Protect the wound adequately and place it at rest. Unnecessary tampering of clean wounds is to be condemned. On surgical wards fully one-half the wounds infected result from carelessness on the part of the attendants.

5. Use anatomic incisions whenever possible.

6. In clean wounds non-absorbable sutures are recommended. Steel alloy suture may be the material of choice in infected cases.

7. The technics of abdominal wound closure must constantly be improved—more gentleness in handling tissues, better hemostasis and more adequate closures without undue tension. So often we see the struggling surgeon trying to close the peritoneal layer under tension while the anesthetist induces the patient with a second general anesthetic. This can only result in tearing the peritoneal membrane and fascia, producing many small defects through which the omentum may wedge and pave the way for deep wound separation. When the effect of the spinal anesthetic is exhausted, relaxation can be much more effectively obtained by local infiltration of the peritoneum from within with novocain than with a second general anesthetic. This can be done in several minutes' time and the results will gratify the surgeon.

8. Heed the symptoms that suggest deep wound separation. They are retching, vomiting, distention, bloody discharge from the wound and a feeling on the part

of the patient that something has given away.

9. The wound must be examined before the skin sutures are removed as most eviscerations occur after their removal. If there is an unusual amount of edema and inflammatory reaction of the cutaneous wound edges, this layer should be spread sufficiently to allow gentle probing of the deeper layers. If the deeper layers have separated, the wound should be secured before the skin sutures are removed.

10. Evisceration must be promptly recognized and emergency measures instituted. Cover the protruded gut with sterile gauze and strap the abdomen firmly. Slight effort such as is required in moving from bed to stretcher and from stretcher to operating table may exceed the patient's tolerance. For this reason, the patient should be transported in his own bed to the operating room. For patients too ill to undergo prompt closure of the wound supportive therapy and delayed closure are preferable. When prompt closure is tolerated, the separated wound is best secured by through-and-through suture. It is doubtful if layer closure is ever indicated. It is wise to cleanse protruding viscera with saline before returning them to the abdomen.

11. In secondary closure local anesthesia is usually preferred; but if a general anesthetic is indicated, the combination of sodium pentothal, oxygen and curare is recommended.

12. The postoperative care must be individualized and closely supervised.

SUMMARY AND CONCLUSIONS

1. Literature pertaining to the problem of wound healing has been reviewed.

2. Data from a statistical study have been presented.

3. Suggestions have been given for the prevention of evisceration.

4. A plan for the management of evisceration has been recommended.

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PRIMARY TREATMENT OF EXTENSIVE BURNS*

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IMMEDIATE death from heat coagulation of some vital structure is of only passing interest. Our problem lies in the management of those patients who are apt to succumb after a period of time. Shock death usually occurs within the first two days, death due to liver necrosis from the third to the fifth days and death from infection from the fourth day on. All three fatal processes have their beginning during the first twenty-four hours. Management at the beginning may determine the outcome, life or death.

Before the recent improvements in the prevention and treatment of shock all patients died who had severe burns involving as much as one-half of the body surface. Vigorous antishock treatment is required to save patients who have as much as one-third of the body surface burned. Detailed accurate surface area charts are useful but difficult to remember in the excitement of a catastrophe. A simple system of computing body surface areas such as that pictured in Figures 1 and 2 is easily remembered and of great value in burn emergencies. Failure to evaluate the prognosis on the basis of body surface may result in loss of lives due to waste of time and material on hopeless cases. Burns that

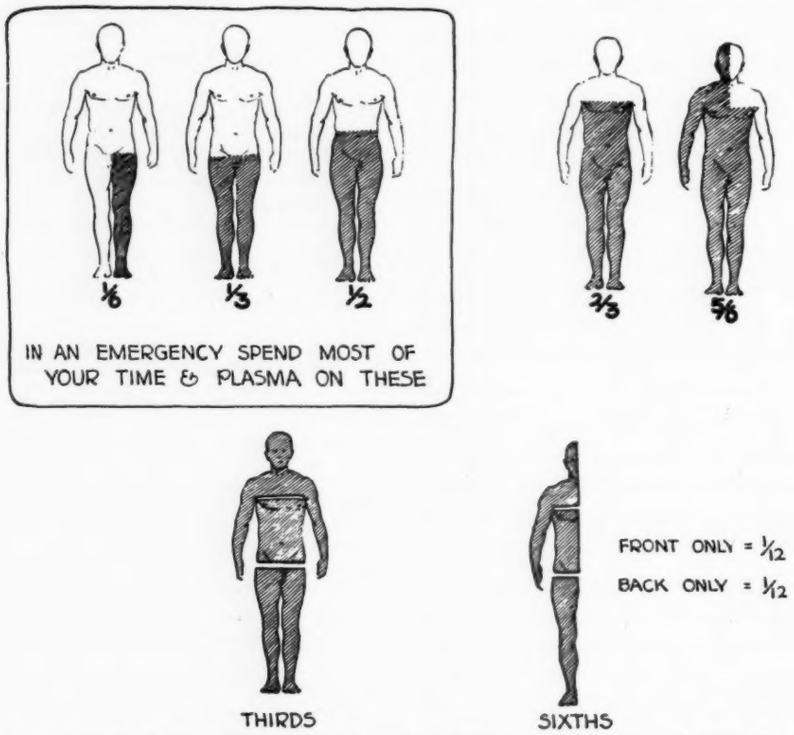

FIG. 1. Surface area computations should not delay rapid handling of casualties in burn catastrophes. Rough estimates can be made without reference to charts or tables by dividing the surface into arbitrary blocks of eights and twelfths.

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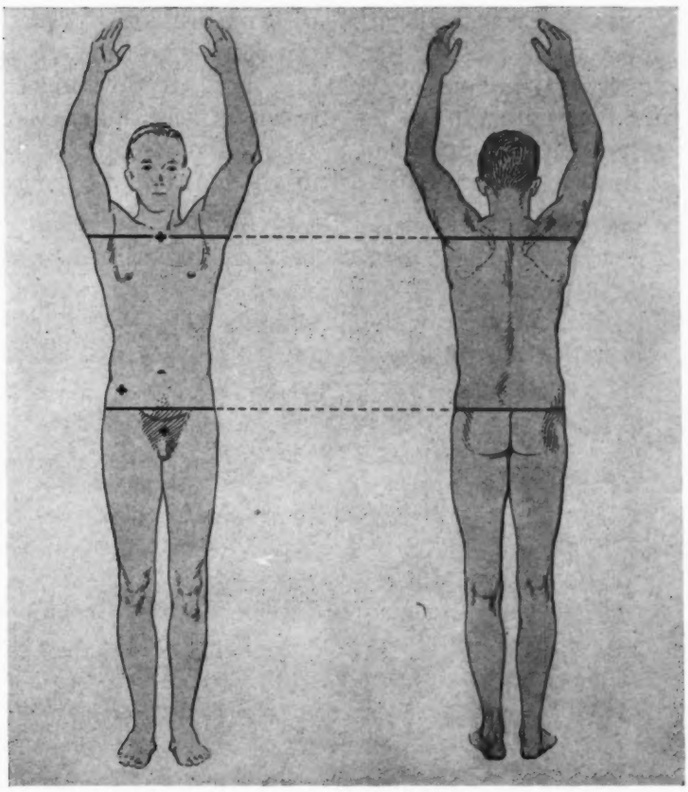

FIG. 2. Note that the upper third includes head, neck, upper extremities and the upper parts of the pectoral and scapular regions. The lower third includes the lower extremities and the buttocks and genital regions.

blister or have the outer layers of epithelium stripped off are quite obvious. Care should be taken not to overlook areas of deep burn which are not blistered. (Fig. 3.) Numbered degrees are used to indicate the depth of burns but there is considerable variation and confusion in the use of terms. Descriptive terminology avoids misunderstanding, for example (1) red or erythematous, (2) blistered or denuded and (3) deep or coagulated.

Human tissue can live within a temperature range of about 40°C. Normal temperature is near the top of this range. In other words, the tissues can be cooled about six or seven times as much as they can be heated without causing necrosis. Extensive burns severely cripple the body's temperature-regulating mechanism. It is obviously safer to allow the tissues to cool off than to have them too warm.

From the practical viewpoint of the burned patient the important consideration is not what should be put on the burn but what should be kept off it. First-aid workers often do more harm than good because they have faith in some germicide or remedy and have not been taught the dangers of droplet inoculation of wounds from unmasked noses and mouths. (Fig. 4.) Coughing, talking, puffing, snorting, laughing and sneezing in the presence of wounds are especially dangerous. We cannot make our surgical staff ubiquitous but we can educate our people in asepsis and train them in efficient enforcement of common-sense precautions against infection.* The first step in the treatment of a fresh burn is either the immediate masking of every nose and mouth present or

* Petrie dish demonstrations of air born bacteria have great educational value. One might also suggest that tobacco smoke be observed as an indication of the extent of contamination by exhaled air.

immediate covering of the burn itself with a sterile cloth to catch the dust and bacteria that are constantly settling out of the air. Masking is just as important when giving first aid as it is in the operating room. In dirty surroundings immediate covering of the burn may be wise even if the covering is not sterile. One must evaluate the danger of air contamination as compared with that of the cleanest covering available and choose the lesser evil. After this immediate covering no one should be allowed to expose the burn without masking all present. The number of bacteria that settle from the air on a given surface is directly proportionate to the time of exposure and to the surface area. Without respect to the fact that burns are more favorable culture media than freshly incised tissues, the smallest burn area (Fig. 1, one-twelfth of the body surface), has more than twenty times as much air contamination hazard per minute as an ordinary appendectomy wound. It is far safer to perform an appendectomy without masks than it is to dress a burn without masks.

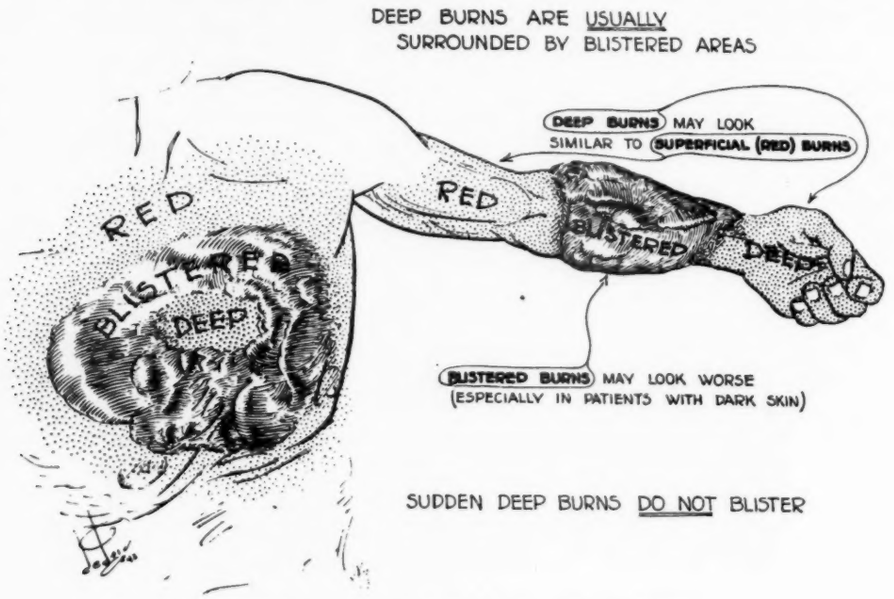

FIG. 3. Beware of overlooking areas of deep burn.

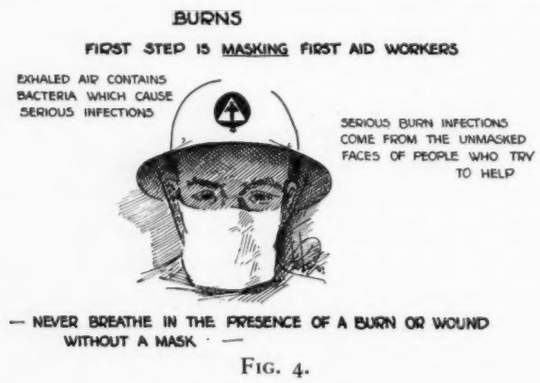
BURNS
FIRST STEP IS MASKING FIRST AID WORKERS
EXHALED AIR CONTAINS
BACTERIA WHICH CAUSE
SERIOUS INFECTIONS
SERIOUS BURN INFECTIONS
COME FROM THE UNMASKED
FACES OF PEOPLE WHO TRY
TO HELP
— NEVER BREATHE IN THE PRESENCE OF A BURN OR WOUND
WITHOUT A MASK —

FIG. 4.

The care of burns requires resourcefulness in the use of available materials to the best advantage and diligence in the avoidance of further injury either bacterial, chemical, thermal or traumatic. This includes occlusion of air, gentle pressure, cooling and rest. It is wise to use a well known method, to avoid harmful effects of untried remedies and also to obtain continuity of management from first aid to hospital. Aseptic cleaning, débridement, washing and irrigation may be good treatment but it is not as good as asepsis from the start.

There has been considerable enthusiasm for the removal of blisters in connection with cleansing but it is extremely doubtful if any of man's dressing preparations are

better adapted to soothe and protect the burned area than the plasma-like fluid or serous exudate which nature supplies. Certainly in the early treatment of burns under conditions of questionable asepsis it is better to leave blisters intact. Careful cleansing and rigid asepsis should always precede blister removal and provision must be made in advance for immediate reapplication of pressure such as the fine mesh vaseline gauze, mechanics waste and tension bandages used by Koch and others.[2-4] Variations in technic for various zones of skin are well known. The patient burned in clean clothes soon after a thorough shower bath does not present as difficult a problem as one who is not clean. Cleansing of contaminated burns is desirable but routine scrubbing of all burns alike is not warranted. The area can be made surgically clean by repeated gentle washing with soap and cool sterile water. Special care should always be taken to cleanse the skin around the burn.

Relief of pain by cooling is remarkable.[5,6] Many have marvelled at the excellent condition of some burn casualties who have of necessity been exposed to sea water. We believe that this is largely due to cooling. Perhaps the chief value of wet dressings is the cooling afforded by evaporation. Wet dressings are usually not suitable for clean burns because they are so readily contaminated. There have been many independent clinical observations of good results obtained with snug dressings over various jellies such as bentonite and even ordinary lubricant. The so-called water soluble ointments fall in this class. The advantage of wet dressings can thus be obtained without the disadvantages. The ideal dressing is immediately available, non-irritating, sterile and smooth. It relieves pain by occlusion of air and by cooling and exerts a uniform pressure, immobilizes and has an external appearance sufficiently impressive to discourage unnecessary changes of dressing. It is left undisturbed for the healing period of blistered or denuded burns, namely, ten days to three weeks unless there are sure signs of infection. The inner layer consists of fine mesh gauze or linen which has apertures too small to admit penetration of granulation tissue. Maintenance of gentle uniform pressure over the burned area can be obtained with various materials such as snug elastic bandages over well padded dressings.

Sulfonamide treatment is warranted in severe burn cases, either by mouth or intravenously, for example, 0.5 Gm. of sulfadiazine and 0.5 Gm. of sulfathiazole. Alkalinization of the urine by administration of sodium bicarbonate is unnecessary with such sulfonamide combinations.[12] Laboratory studies should include urine volume, specific gravity and microscopic search for sulfa crystals and red blood cells as well as repeated blood counts while sulfonamides are being used.

Penicillin (50,000 units every three hours) is apparently as effective and safer than sulfonamides.

Tetanus antitoxin or tetanus toxoid, "booster dose," is indicated in the treatment of burns. Occlusive dressings favor the development of anaerobic infections.

SHOCK

Ashen pallor, cold clammy skin, restlessness, rapid shallow respirations, astoundment of the mental faculties, feeble pulse, falling blood pressure and reduced blood volume are familiar characteristics of shock which should be prevented. Restlessness is due to an insufficient amount of blood for proper functioning of the circulatory system. Reflex movements pump the meager venous return out of the extremities back to the heart as fast as possible. Although the shock patient needs rest, such movements should not be restricted because life depends upon them until the blood volume is replenished.

Shock is an ambiguous term but it is preferred to "progressive hypoxia due to hemoconcentration, oligemia and vasoconstriction." Loss of plasma-like fluid (exudate, blister fluid, edema fluid, etc.)

may embarass the circulation in at least two ways: the blood volume becomes insufficient for the needs and the blood becomes too viscous for proper circulation. Blood, like syrup, becomes more viscous as it becomes more concentrated. However, in the syrup the change is continuous and uniform whereas in blood the viscosity suddenly increases very rapidly when a certain degree of concentration is reached due to contact of the cells. The loss of blood volume and the increase in viscosity both reduce the efficiency of the circulation in its task of carrying oxygen to the tissues. If the circulation is thus allowed to become inefficient and the tissues hypoxic, part of the resultant damage is described as increased capillary permeability, that is, loss of plasma-like fluid through capillaries becomes general whereas at first it was confined to the burned area. This vicious circle is the state of fatal shock. (Fig. 5.) Adequate circulation can be maintained by promptly making up the plasma which is lost as a direct result of the burn. However, if one allows time to elapse in a state of tissue hypoxia, enormous volumes of plasma may be needed to supply that lost in tissue distant from the burn.

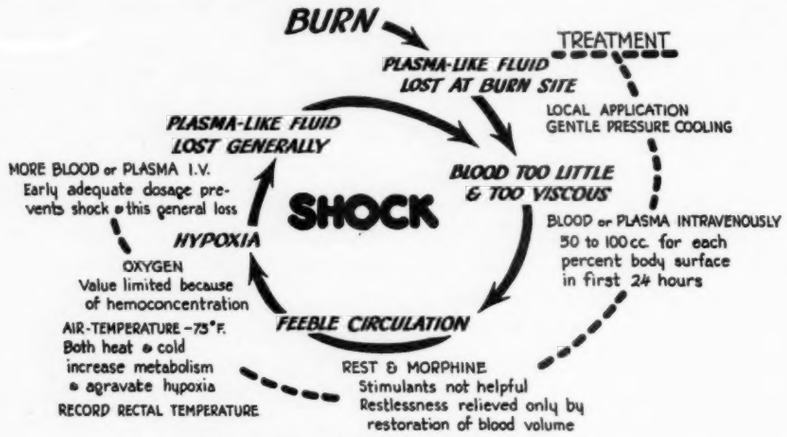
BURN
TREATMENT
PLASMA-LIKE FLUID LOST AT BURN SITE
LOCAL APPLICATION GENTLE PRESSURE COOLING
PLASMA-LIKE FLUID LOST GENERALLY
MORE BLOOD or PLASMA I.V. Early adequate dosage prevents shock & this general loss
BLOOD TOO LITTLE & TOO VISCOUS
SHOCK
BLOOD or PLASMA INTRAVENOUSLY 50 to 100 cc. for each percent body surface in first 24 hours
HYPOXIA
OXYGEN Value limited because of hemoconcentration
FEEBLE CIRCULATION
AIR-TEMPERATURE -75°F. Both heat & cold increase metabolism & agravate hypoxia
RECORD RECTAL TEMPERATURE
REST & MORPHINE Stimulants not helpful Restlessness relieved only by restoration of blood volume

FIG. 5. The vicious circle of burn shock.

Local treatment of the burn is frequently delayed until the initial shock is controlled. Actually, local and general treatment should proceed simultaneously because it is the local condition that causes shock. Transportation of the patient tends to aggravate shock but transportation to a hospital as soon as possible after first-aid covering is necessary. Provision should be made for intravenous administration of blood or plasma during delays. Administration during transit is usually impractical. Bone marrow infusions have been suggested for use in moving ambulances. This can be done but is of doubtful wisdom because bone marrow is far more susceptible to infection than the general circulation.

The amount of blood or plasma needed is somewhat variable. Laboratory measurements of blood concentration (blood specific gravity, hematocrit, red blood count, hemoglobin, etc.) are difficult if not impossible in an emergency and they are only indications of derangements which should have been prevented. Any extensive burn patient should be given 2 pints of blood or plasma as soon as possible. The more extensive the burn the more blood or plasma needed. The amount can be judged by this rule of thumb: *During twenty-four hours give a total of about* 100 *cc. of whole plasma or blood for each per cent of body surface severely burned.*[7] Half of this amount is advised by some on the assumption that a laboratory study will be made within a few hours and more blood or plasma given; for example, a patient with a severe burn of 50 per cent of the body surface needs about 5,000 cc. of blood or plasma (1 per cent 100 cc., 50 per cent 5,000 cc.). This should

be started early. The speed at the beginning may depend somewhat upon the patient's condition but ordinarily one should plan to give it slowly and continuously using half of the twenty-four hour dose during the first twelve hours. This rule is applicable chiefly in severe burns of from one-sixth to two-thirds of the body surface. One must not forget that extra plasma will be needed if the original treatment is delayed. The ideal plan is to replenish the plasma loss as soon as it occurs. *Hemoconcentration and signs of shock should not be allowed to develop.* The aforementioned arbitrary rule and the urine volume and specific gravity enable one to estimate the fluid needs. The appearance of the patient is often not a good guide to the need for plasma. A burned patient may run to an aid station for relief of pain and be apparently quite strong for several hours then sink rather suddenly into shock. Success in treatment depends upon anticipation and prevention.

Whenever possible hemoconcentration should be evaluated by laboratory methods such as blood specific gravity, red blood counts, hemoglobin, hematocrit, etc. Perhaps the simplest quick therapeutic rule for the average adult is to give 100 cc. plasma for each point the hematocrit exceeds the normal of 45.[8] When the hematocrit is found to exceed normal, the first-aid plasma treatment has been inadequate; the deficit should be corrected promptly. If the hematocrit is found to be less than normal, the first-aid treatment has been good; no untoward effects need be expected from overdosage with plasma in the absence of pulmonary burns. Too little plasma therapy accounts for many fatalities. Although too much blood or plasma therapy is theoretically dangerous, accounts of harm from overdosage are conspicuous by their absence. Administration should be spaced in time to meet the needs as they develop. The best single method of evaluating the state of the blood volume is observation of the superficial veins of an unburned area. When blood volume decreases, the veins are small, usually invisible, even when the part is dependent. When the blood volume is normal, the subcutaneous veins, for example, on the dorsum of an unburned hand, are visibly filled with blood when below the level of the heart. If the superficial veins are watched, there is no danger of overdosage with human plasma or blood.

In the light of modern knowledge there is no excuse for external application of heat in the treatment of burns in ordinary surroundings.[9] Metabolic processes follow the general chemical law of van't Hoff that the speed of reaction is in direct proportion to the temperature. Cooling of the extremities, which is such a well known characteristic of shock, is a natural beneficial phenomenon. Shock may be described as oligemic hypoxia. Heat increases the oxygen use and thereby increases the hypoxia for which the oligemic organism cannot compensate. Every effort should be made to make the burned patient comfortable but heat should not be supplied unless the patient feels the need of warmth. Rectal temperatures should be recorded. Unconscious patients need about the same amount of covering as nearby conscious patients.

GLUCOSE AND SALT

Glucose may be given intravenously but sweets by mouth are better if they can be retained. Lemon drops or some other similar confection may be given; sweetened drinks may be tried cautiously. If started early this may reduce the gastric symptoms which are said to be due to hypermotility from the pressor effect of the burn. Be this as it may, glucose is thought to afford needed protection of the liver. Sugars taken by mouth are preferred; they enter the portal circulation whereas those given intravenously are dispersed in the general circulation. When the patient is unable to take sweets by mouth, intravenous glucose 5 per cent solution in physiologic saline or distilled water should be given, preferrably alternating with blood or plasma. The best

guide to the adequacy of the fluid administration is the urinary output.

Salt has been found to reduce the mortality rate of burn shock in mice. Oral administration is apparently better than intravenous.[10] Saline, one-half teaspoon of salt to a glass of water, is given in small sips by mouth but may not be retained. Salted barley or rice water is excellent if available.

Morphine is useful to control the pain of burns. It should not be given unless there is pain. There is some danger of overdosage. Watch for the signs of morphine poisoning, slowed respirations and pin-point pupils, after local applications which afford relief of pain and after restoration of the blood volume. The average severely burned adult needs morphine, ¼ to ½ gr., at once probably repeated within the first hour and again every two to four hours as needed. Intravenous morphine acts promptly and leaves no danger of delayed poisoning.

Atropine in small doses is advised to combat the initial pressor effect of the burn, hypermotility, vomiting and ulceration. From 1/300 to 1/150 gr. may well be given with the first dose of morphine.[11]

Oxygen should be administered whenever there is any burn of the respiratory tract, however little. Oxygen is also of help in severe burn cases that have no respiratory tract involvement. It lessens hypoxia and thereby lessens shock.

WARNINGS

Never injure a burn with antiseptics, trauma or more heat.

Never expose a burn to contaminated air. Mask everyone present.

Do not waste time and materials on hopeless burn cases when other patients who need your care are at hand. Under emergency conditions you may save the largest number by neglecting the very extensive and the minor burn cases.

Never use restraints for the restlessness of shock. Restore the blood volume.

Do not allow blood concentration to occur. Elevation of the hematocrit indicates that plasma and blood administration has been inadequate. Total blood and plasma required in the first twenty-four hours amounts to about 100 cc. for each per cent of body surface severely burned.

CONCLUSIONS

1. Proper first-aid care of burn casualties requires education of the public in the principles of asepsis, especially in the dangers of respiratory droplet infection.

2. The aims of early burn treatment are: relief of pain; aseptic rest, firm uniform pressure, moderate cooling; replacement of blood, plasma, glucose and salt and water at rates commensurate with the losses and adequate systemic infection prophylaxis, employing sulfonamides, penicillin and tetanus antitoxin or toxoid.

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SPECIAL PROBLEMS IN RECONSTRUCTIVE SURGERY IN THE AMPUTEE*

LOWER EXTREMITIES

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THE amputated limb ordinarily presents no particular problem from a plastic surgery standpoint. The high explosives of industry and warfare, however, often necessitate amputation of a portion of a limb and, in addition, produce sufficient damage to the remaining stump to make successful management of a prosthesis impossible. It is not unusual for the opposite limb to be involved as well, perhaps to a point requiring amputation.

In such injuries one is faced with three separate problems: (1) production of a well shaped, painless stump, (2) elimination of scars proximal to the stump that would not tolerate the trauma of prosthetic appliances well and (3) reconstruction of the opposite limb.

Amputations of the guillotine type are usually preferred following severe trauma. For reasons to be discussed herein all possible length should be preserved. After the bone end is well covered with healthy granulation tissue, much healing time can be saved by covering it with a thin Thiersch graft. It should be emphasized that no portion of a limb proximal to the permanent stump level should be considered as a donor site for any type of graft. Some individuals produce keloid in areas where even extremely thin dermatome grafts are taken. This tendency is greatly increased in the event of postoperative infection. Such a scar on a thigh which must carry a leather cuff or lacer is unfortunate and avoidable.

Amputation Stump. Revision of the stump end by the sacrifice of unneeded bone length and preparation of appropriate skin flaps is a well standardized orthopedic procedure and needs no further comment. Attempts to preserve bone length by transplanting pedicle flaps of skin and subcutaneous fat over weight-bearing stump ends have proved unsatisfactory. Where skin traction has been faithfully applied during the initial healing period, the addition of skin to cover stump ends is usually not necessary.

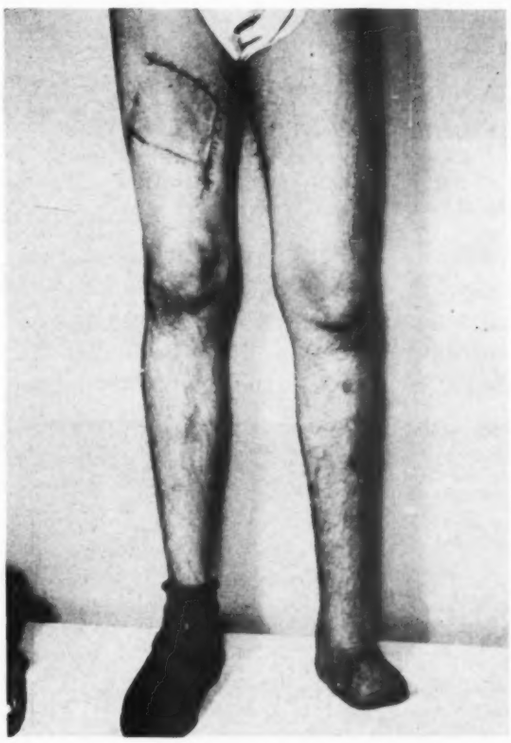


FIG. 1. Flap on left tarsometatarsal amputation stump replacing guillotine scar over bone ends; grafted donor area seen on anterior surface of left thigh. Shortening of this stump to allow approximation of local flaps would have necessitated sacrificing a well functioning ankle.

A notable exception to this is in the case of partial foot amputations. Although the

* From the McCloskey General Hospital, Temple, Tex.

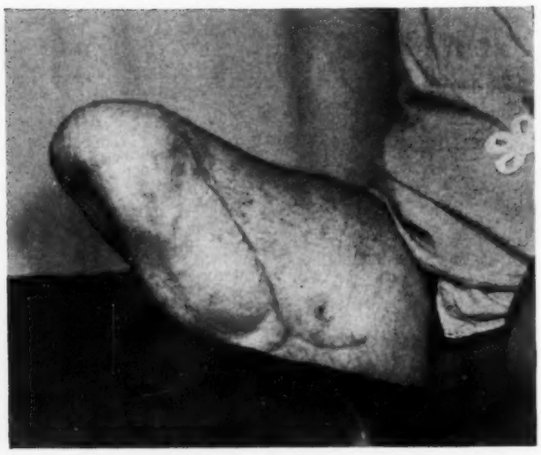
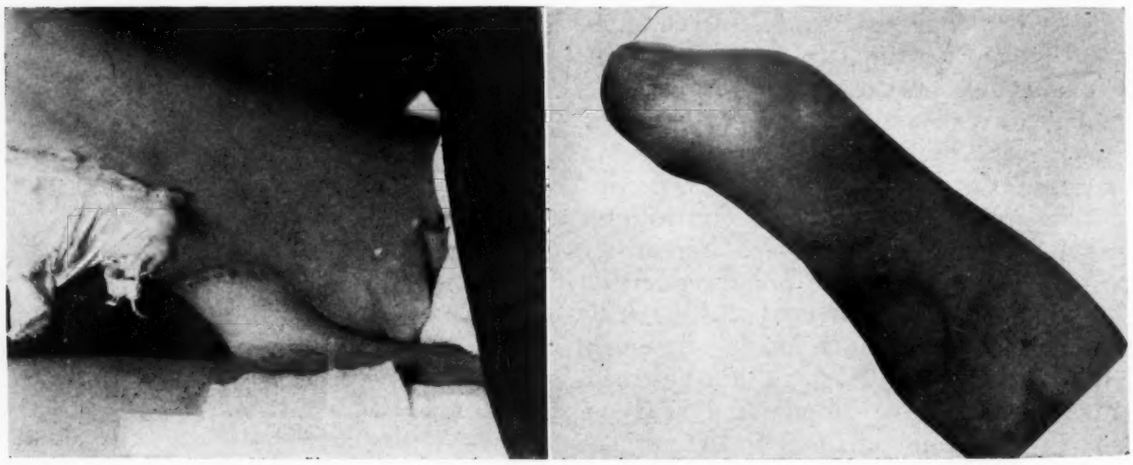


FIG. 2. A grafted thigh stump in a 200 pound man after one year of wearing a prosthesis; no breakdown in graft or scar.

advisability of preserving a partial foot is somewhat controversial, it seems logical that when there is good ankle motion and good motor power in both dorsiflexion and plantar flexion the foot, with all possible length, should be retained. Anything shorter than a tarsometatarsal level should not be considered adequate. Scar tissue on the ends of stumps beyond this level should be replaced by pedicle tissue carrying a thick pad of fat and fascia. These flaps must always be secured from distant donor areas. (Fig. 1.)

Limb Proximal to the Stump. There are occasions when extensive, superficial, soft tissue injury occurs at a higher level than the bone and deep soft tissue damage requiring the amputation. In such instances the defect should be carefully prepared and grafted. The graft applied should be as thick as seems compatible with a complete "intake" under the existing conditions. One should anticipate subsequent removal of graft and scar by multiple excision or pedicle tissue transfer; but if one obtains a 100 per cent "take" and there is sufficient underlying soft tissue to buffer the trauma of a prosthetic appliance, further revision may not be necessary. (Fig. 2.) On the other hand, dense scars within the graft or around its borders will necessitate their elimination by multiple excision or transplantation of flaps. Shifting of local flaps may produce additional scarring and thus may be less desirable than supplying pedicle tissue from a distance. In general, it is preferable to produce a scar on a normal limb rather than extend the limits of a scar on one with an amputation stump.

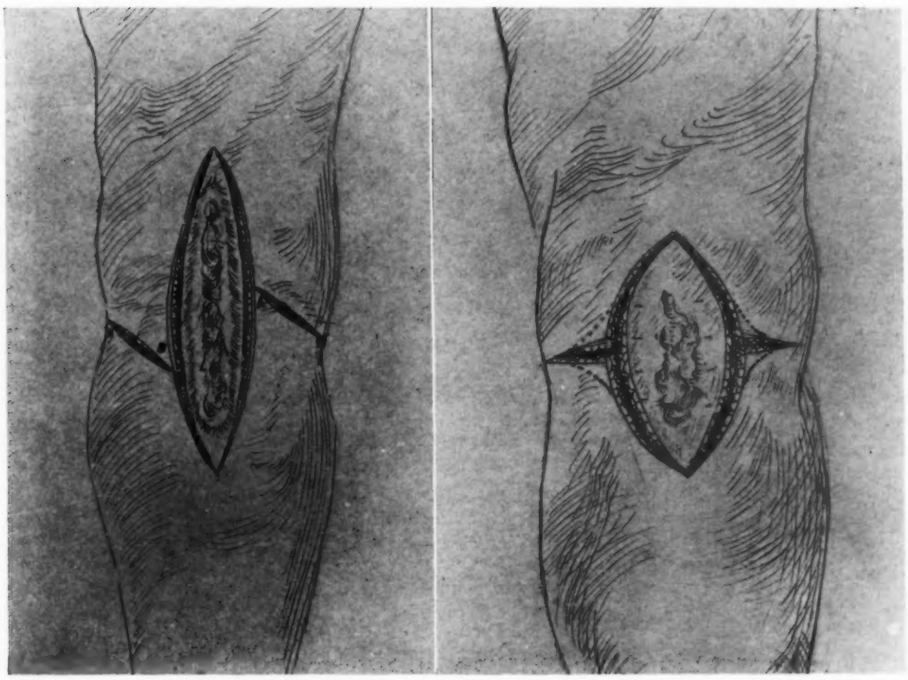


3A 3B

FIG. 3. A, a direct, closed pedicle flap from the medial surface of the left thigh has been attached to the right thigh; B, a dense, deeply penetrating scar has been replaced by a durable covering of skin and fat.

There are three sources of supply for pedicle tissue for the thigh. The upper and lateral portions can be supplied by abdominal tubes which may require waltzing. The medial and lower portions are accessible to flaps from the opposite thigh or calf. (Fig. 3.)

It is seldom necessary or desirable to



4A 4B

FIG. 4. A, the elliptically excised scar serves as all or part of the central member of the Z. The lateral members, usually laid out at 60-degree angles, are planned so that their distal ends (A and B^1) lie on or near the popliteal crease line; B, the wide, contracted scar is excised elliptically and relaxing incisions made medially and laterally. The joint is straightened, opening up the defect. The edges are trimmed as shown by dotted lines and a thick split-thickness graft inserted. The joint is splinted in extension during healing.

supply pedicle tissue to a below—knee stump since it is usually possible to eliminate sufficient underlying soft tissue and bone (fibula) to permit excision of scar and closure without tension.

It should be emphasized that wherever feasible multiple excision is the method of choice. The incisions are kept within the scar-tissue borders until the final stage of excision, at which time undermining (and therefore skin tension) is minimal, and a fine scar can be obtained.

Scar contractures across flexion creases are not infrequent and are particularly troublesome in the popliteal area. Here they frequently represent the wound of entrance of a missile which disrupted the popliteal artery and produced a circulatory insufficiency leading to amputation of the lower leg. Ill advised surgical incisions which cross flexion creases at or near the midline may produce the same result. If the scar is 1½ to 2 cm. in width, it is best corrected by a generously planned Z-plasty, the individual members being approximately 5 to 6 cm. (Fig. 4A.) Smaller than this the offset will be ineffective and beyond this closure will be difficult without undue tension.

When scars in excess of 3 cm. are excised and the joint straightened, the defect will be too large for closure except by skin graft. If a simple elliptical excision is done and graft applied, the two borders will hypertrophy where they cross the flexion crease. This is avoided by extending incisions medially and laterally and inserting a diamond-shaped graft. (Fig. 4B.) Where the contracture has existed for some time, shortening of tendons and periarticular structures may require separate consideration.

Consideration of the Opposite Limb. The remaining whole limb of the unilateral amputee is of particular importance in considering the entire problem of reconstruction. This limb must assume an added

5A 5B

FIG. 5. A, extensive bone and soft tissue defect below the left knee covered by large local flap preparatory to bone graft; patient also has a high thigh amputation on the right. This flap was delayed twice before final 90-degree rotation; B, anterior view three weeks following final stage.

functional burden and is frequently hindered in doing so by simultaneously acquired injuries.

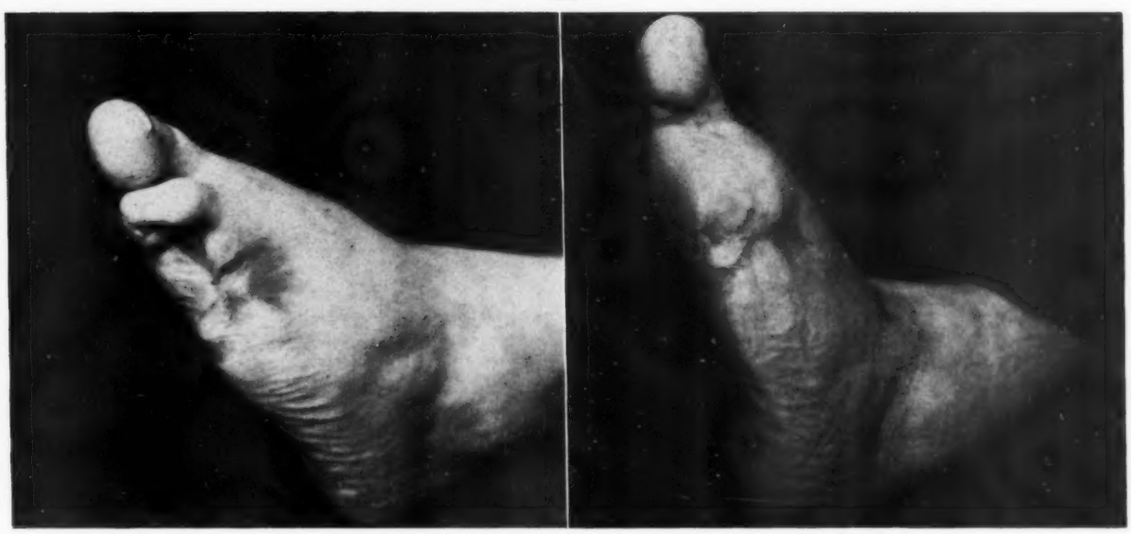
When there is extensive damage to the deep structures necessitating bone grafting, tendon or nerve repair, etc., one must first provide full thickness surface covering. This can be accomplished by local tissue or by pedicle tissue from a distance. With the opposite member unavailable as a convenient donor, however, the latter method should be utilized only when local tissues are inadequate.

Local or rotational flaps are laid out in good tissue directly adjacent to a given defect and rotated up to 90 degrees. (Fig. 5.) The newly created defect is grafted immediately. The base of the pedicle should be directed proximally for a maximum blood supply. Pedicles may be based distally with confidence in the lower one-third of the thigh because of the rich circulatory anastomoses about the knee joint. If the ratio of length to width is greater than 1.5:1, the flap should be delayed. Delay is similarly indicated if excessive torsion or tension is unavoidable. In every instance one must be guided more by the appearance of the elevated flap in the operating room than by any rule of thumb. One of the most common mistakes is to underestimate the length of flap tissue needed. This should be carefully checked preoperatively with consideration for retraction of skin edges of the defect after excising the scar, contraction of the flap when elevated from its bed due to intradermal elasticity, convexity (where present) of the defect to be covered and degree of rotation which will be necessary. The most common causes of failure are (1) inadequate pedicle tissue due to improper planning, (2) circulatory failure (venous congestion due to excessive torsion or arterial insufficiency due to tension) and (3) infection, especially in old osteomyelitic areas. (Fig. 6.)

Local tissues adjoining the area in question may be unsuitable for such procedures because of scarring. Or, as in the case of large defects of the lower leg it may be considered unwise to risk a relatively large percentage of the remaining circumference of normal tissue. We have observed cases in which such ill advised ventures resulted in failure of the flap and produced a constricting band of scar tissue encircling the lower one-fourth of the leg. The inevitable chronic circulatory stasis and tendon immobility functionally wrecked the limb. Such an outcome, always unfortunate, is a real catastrophe in an amputee

For these cases the transfer of pedicle tissue from a distance is the procedure of choice. Two donor areas are available for consideration, viz., the thoracico-abdominal area (using the wrist as carrier) and the ipsilateral thigh (using the opposite thigh as carrier). Both these transfers are best

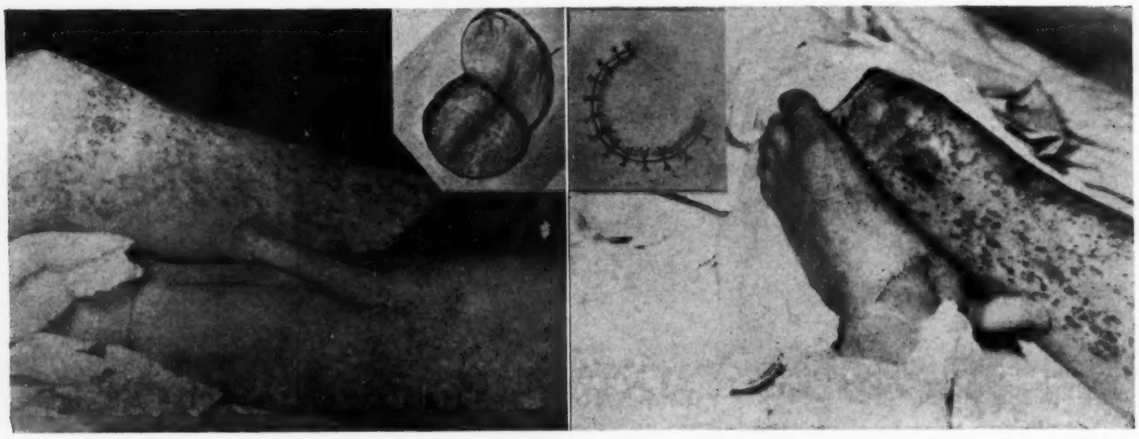
6A



6B 6C

FIG. 6. A, the utilization of a double pedicled flap to replace a plantar scar; a skin graft is inserted into the defect created by the relaxing incision. This is a highly useful procedure and if the length-to-width ratio is no more than 3:1, it need not be delayed. B and C, because of their durability foot tissues are always preferable for foot reconstruction when available. Here a useless, painful toe serves to replace a dense, ulcerated scar. Through a mid-lateral incision the phalanges were disarticulated and shelled out. The soft tissues were then utilized as a flap as shown.

accomplished with tubed pedicle flaps because of the necessity of utilizing an intermediate carrier. The abdomen as a donor area has the advantage of greater availability of tissue but has a great mechanical disadvantage in approximating the wrist-attached pedicle to the leg; for that reason the thigh is preferred in most cases. A tube is prepared on the anteromedial surface of the ipsilateral thigh which contains sufficient tissue by itself or together with an anticipated pancake to repair the defect



7A 7B

FIG. 7. A, the right leg was amputated below the knee and the left heel avulsed by an antipersonnel mine. Extensive tattooing of the right thigh by foreign material is shown. The tube has been sutured into the semicircular flap and its defect (inset). A small "pancake" flap has been delayed at the proximal end. B, the proximal end of the tube has been transferred to the heel defect. Inset shows closure of the carrier site defect.

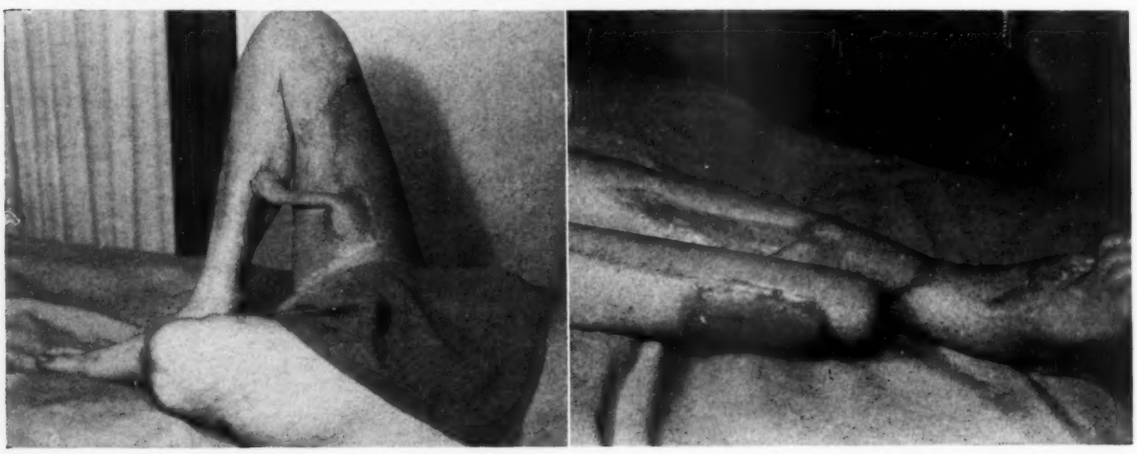


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FIG. 8. A time-saving method of pedicle transfer which is occasionally applicable; with the opposite thigh obviously unavailable as a donor area the only alternative procedures are an abdominal pedicle carried down on the wrist or a right thigh pedicle as shown transferred via the thigh stump as carrier.

FIG. 9. A stump of excessive length provides an easily accessible source of pedicle tissue. Here two-thirds of the circumference of stump have been utilized to cover a large bony and soft tissue defect of the opposite leg. All open areas have been grafted. The stump is to be reamputated 7 inches below the knee.

involved. The thigh of an amputation which is performed below the knee can then be utilized as a carrier. This may appear to be a contradiction of the statement made above that no avoidable scar should be added to a limb that must wear a prosthesis. In this instance, however, one has complete control over the placement of a scar which is minimal. Indeed, the mechanics of the pedicle transfer must be planned with such a placement in mind. The scar must be situated where it will not come in contact with any closely fitting part of the prosthetic appliance. In order to accomplish this with a minimum of scarring, the bed for receiving the pedicle is prepared by reflecting a semicircular flap, the dimensions of which are one-half the circumference of the end of the pedicle to be attached. (Fig. 7.) After the transfer is completed, this flap is sutured back into place.

Another method of transfer can occasionally be utilized when the knee joint of the injured extremity has an unusual range of mobility. (Fig. 8.) The tube is prepared

low on the thigh and transferred to the leg with the knee immobilized in acute flexion. Where applicable, this method eliminates employment of an intermediate carrier with consequent economy of time and effort. It illustrates the principle that each problem should be approached by the most direct means consistent with the best possible anticipated end result.

Immobile hip or knee joints seriously hinder transfer of pedicle tissue from a distance and one must then make a choice between utilization of local tissues or time-consuming waltzing procedures.

A third donor area which may occasionally be available is an amputation stump of excessive length which must eventually be shortened for optimum function. Amputations through the ankle which are later to be reamputated below the knee are examples. Before the revision is done, any of the tissue below the site of election may be utilized as a pedicle flap for transfer to the opposite limb. (Fig. 9.) This area is also an excellent donor source for a bone graft.

SUMMARY

Factors causing the partial loss of a lower limb may simultaneously produce extensive injury to the remaining portions of the same limb as well as to the opposite limb. The restoration of these parts assumes special importance by virtue of the added functional burden placed upon them. At the same time, the nature of the demands for minimal scarring of the amputated limb imposes restrictions which complicate the selection of effective plastic reconstructive procedures. Several methods of circumventing these obstacles are offered.

UNUSUAL ANAL, RECTAL AND PERIRECTAL TUMORS PALPABLE BY RECTAL EXAMINATION*

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TUMORS of the anus and rectum can be palpated. The common malignant and benign neoplasms (adenocarcinoma, polyps) of the anorectum are rarely confusing. However, there is a group of unusual tumors in this area which is often confused with carcinomas; the tumors are misdiagnosed because of their deviant pattern or are mistakenly accepted as benign growths. This unusual group involves important diagnostic and therapeutic problems.

The following tumors were seen at our Institution from 1930 to 1947: malignant melanoma of the anorectum, hemangioma of the rectum, malignant leiomyoma of the rectum, lymphosarcoma of the anorectum, synchronous carcinomas of anus and rectum, retrorectal or sacrococcygeal teratoma and chordoma, sacral region.

MALIGNANT MELANOMA OF THE ANORECTUM

During the period of our study 50,147 patients were admitted to the hospital. Of this number 1,818 had rectal carcinomas, 60 had anal carcinomas and 4 had melanomas of the anorectum.

The clinical diagnosis of malignant melanoma of the anorectal area is difficult. Furthermore, these tumors are considered to be particularly malignant. This is probably true not because of the intrinsic malignancy of the tumor itself but rather because of the delay in diagnosis incident to its location, the various avenues and rapidity of spread and the inadequate treatment usually afforded.

Melanomas of the anorectal area may be multiple, sessile or pedunculated and of variable size. About one-third may contain little or no pigment. The rectal mucosa may remain intact except when necrosis occurs. These tumors occur chiefly in adults and arise from the anal orifice or from the rectal ampulla. They present the usual structural appearance of melanoma.[6] The origin, chemical structure and histogenesis of anorectal melanomas have been adequately reviewed by Bacon and Pena.[1]

Pack and Livingston state that if the melanoma is operable (i.e., if the tumor is not fixed and has not metastasized to viscera or distant regions), the treatment should be abdominoperineal excision with subsequent prophylactic or therapeutic bilateral groin dissection.[13] Certainly this procedure is warranted since radiation therapy offers nothing. Unfortunately the diagnosis of anorectal melanoma is usually made quite late and radical procedures are then deemed inadvisable and ineffective.

Up to the present eighty-eight cases have been reported, one of these in a Negro.[10] Four patients admitted to our Service are herewith described:

CASE 1. J. S., a fifty-six year old white male, a dye mixer, was referred to us in August, 1945. He had complained of blood in his stools in June and had undergone a rectal operation in July. The doctor's letter of referral described the removal of a polyp only. However, our pathologist's report read: "Pigmented malignant melanoma invading the mucosa."

Digital examination of the rectum disclosed an indurated area with granulation tissue on the anterior rectal wall just above the anorectal junction. No evidence of any tumefaction was seen. Nodes were present in both groins but these were deemed not involved. A chest film was suggestive of infiltration. Six gold radon seeds, 1.0 mc. each, were inserted into the involved area. The patient was then seen in November, 1945, and examination of the

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rectum revealed no evidence of tumor. However, the patient died at home in March, 1946, of the disease.

In this case, the original examining physician thought he was dealing with a polyp and consequently considered a local excision of the tumor adequate therapy.

CASE II. M. A. G., an eighty-five year old white female inmate of the State Hospital, was being treated for scabies when a prolapsed rectum, hemorrhoids and a suspicious rectal tumor were seen. An adequate history was not obtained.

Digital examination of the rectum revealed a fungating tumor protruding from the anal ring which did not involve the rectum. Biopsy revealed a pigmented malignant melanoma of the anus. (Fig. 1.) The tumor was removed by cautery and eight gold radon seeds totalling 14.2 mc. were inserted into the base. The patient was seen five months later when metastatic nodes in the right groin were present and ulceration was also observed in the anal canal. She died of the disease six months after her referral.

Although we observed the case from the beginning, our preoperative clinical diagnosis was incorrect and our treatment certainly inadequate.

CASE III. E. S., a fifty-seven year old white female, stated that two years prior to admission she had had a hemorrhoidectomy. She had been well until the past three-month period when anal itching and a bloody, purulent discharge from the rectum was noticed.

Digital examination showed an ulcerating, bleeding, cauliflower mass at the anal orifice. Biopsy revealed a non-pigmented melanoma. The growth was removed by cautery and five gold radon seeds totalling 5 mc. were implanted into the base of the lesion. Seven months later a metastatic node appeared in the right groin and the patient received irradiation therapy to this area. Some time later the patient developed lung metastases and received irradiation to the lung. She died of the disease two years and five months after her referral.

CASE IV. M. G., a seventy-five year old Italian female, had noticed bright red blood on toilet tissues and stools during the past three months. In addition she complained of profuse rectal bleeding, painful defecation, constipation

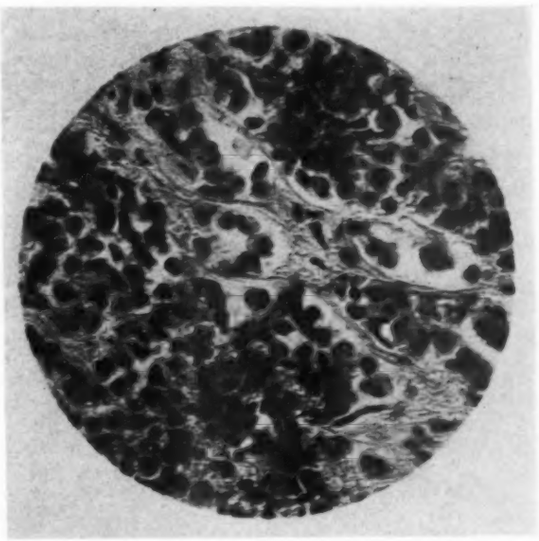

FIG. 1. Case II. Malignant melanoma of the anus; section shows an infiltrative malignant melanoma with variation in size and shape of tumor cells. Very little pigmentation was noted in the growth.

and diminution in caliber of stool occurring within the past five weeks. She also stated that she felt a mass in her rectum.

She had lost 10 pounds although her appetite continued good and she was able to tolerate any type of food without nausea or vomiting. There was no history of previous illness or operation.

The examination revealed a poorly nourished, acutely ill female with bilateral edema of the lower extremities. Examination of her abdomen was essentially negative except for bilateral inguinal adenopathy. Rectovaginal examination showed a large, papillary, cauliflower-like tumefaction present in the anorectal area which was palpable through the posterior vaginal wall. Biopsy revealed a malignant melanoma.

Because of the patient's poor condition and metastatic groin involvement, a perineal resection was done as a palliative procedure. The patient was discharged with the perineal wound healed and the colostomy functioning. She expired four months later. Necropsy revealed malignant melanoma of anorectum invading the bladder, with metastases to liver.

These cases demonstrate clearly the inadequacy of any conservatism in dealing with anorectal melanomas. While it may be true that at the time of admission to the hospital the patients may have distant

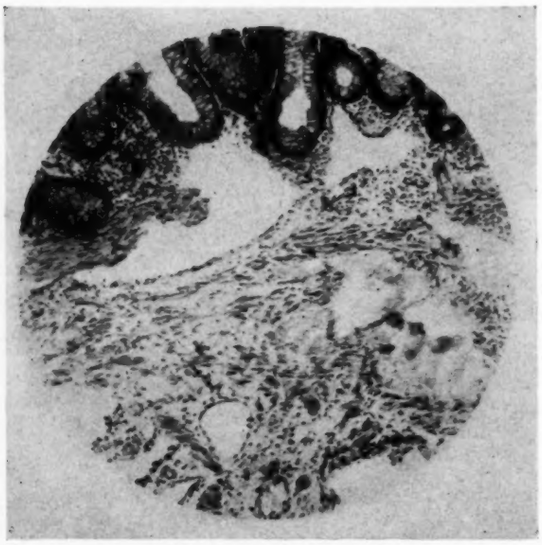

FIG. 2. Case v. Hemangioma of the rectum; section shows dilated vessels filled with red blood cells below the rectal mucosa.

foci of metastasis not clinically apparent or visible by roentgenograms, nevertheless, the full benefits of radical surgery should be offered them.

HEMANGIOMA OF THE RECTUM

Several hypotheses relative to the etiology of hemangioma of the rectum have been promulgated. The most logical one is that it is congenital in origin.[4] The most prominent symptom is repeated bleeding from the rectum, often beginning in infancy.[2] This symptom plus a doughy or nodular-like character of the involved wall is practically pathognomonic. In many instances hemorrhoidectomy has been performed without satisfactory cure.

Hemangiomas of the large bowel are rare and the condition may involve serious complications. The treatment may often be unsatisfactory and death may occur from hemorrhage. Buie and Nesselrod believe treatment by radiation has no value and surgical excision of the affected part with a permanent stoma is the only means of treatment.[4] Our cases would tend to disprove this contention. It is true that the concomitant hemangiomatous involvement of large portions of the colon as well as multiple areas would militate against radiation therapy as treatment. However, an isolated rectal lesion ideally located is amenable to radium, seeds or irradiation, and can be treated with radiation therapy and/or surgery.

CASE V. M. E. W., a twenty-four year old white female, was admitted in April, 1934, with a history of almost continuous rectal bleeding since childhood unaccompanied by pain or mucus discharge. She had been given ten irradiation treatments (factors unknown) elsewhere in 1933. She had undergone a hemorrhoidectomy in 1929. Family history was essentially negative. The patient was a gravida 4, para 4, all normal pregnancies.

Examination revealed a soft, doughy tumor involving the lower rectum. The tumor was movable and seemed to be covered with mucous membrane. It was impossible because of the bulk of the tumor to insert the proctoscope above the area without causing bleeding. A section was taken and a diagnosis of hemangioma of the rectum was made. (Fig. 2.)

The patient was treated with the 4 Gm. radium pack to the anterior pelvis and sacrum. She was then seen at monthly intervals and no bleeding was noted. However, six months after treatment she began to bleed again and considerable angiomatous tissue was noted in the rectum. The patient was then given irradiation over the pelvis. The bleeding ceased but the angiomatous mass remained with some evidence of regression.

The patient was not seen again until May, 1940, approximately five and a half years after treatment. At this time examination of the rectum revealed that the hemangioma had been replaced by fibrous tissue. She was last seen in May, 1944, at which time she stated that she had had no rectal bleeding. The rectal findings were similar to those in 1940.

CASE VI. M. B. C., a fifty-seven year old white female, was admitted to our Institute in November, 1942. She was a gravida 6, para 6 who ceased menstruating in 1937. About six weeks prior to admission she had an attack of indigestion which consisted of nausea, vomiting, pain in the abdomen and diarrhea. She recovered in a few days. Three weeks later she had an onset of marked diarrhea without blood, pus or mucus but accompanied by cramp-like pains across the lower abdomen. Few symptoms referable to the gastrointestinal tract were present on admission. She had lost

10 pounds, was weak and tired. The abdominal examination was negative.

Digital examination of the rectum revealed a nodular area of induration at the junction of the middle and upper third or the rectum. The nodularity seemed to involve the submucosa and muscularis of the rectum and had caused some fixation. Proctoscopic examination revealed a markedly edematous-looking mucosa but no definite tumefaction could be seen. Biopsy was taken and a histologic diagnosis of angioma was made. The patient received irradiation with the following factors: 200 K.V. machine, 20 by 20 cm. field size over the anterior and posterior pelvis at 80 cm. T.S.D., HVL 0.9 mm. Cu 200r skin dose daily for a total of 2,552r tumor dose.

The patient has remained free of any gastrointestinal complaints. There has been no recurrent disorder in the rectum and when last seen in 1947 there was no evidence of disease.

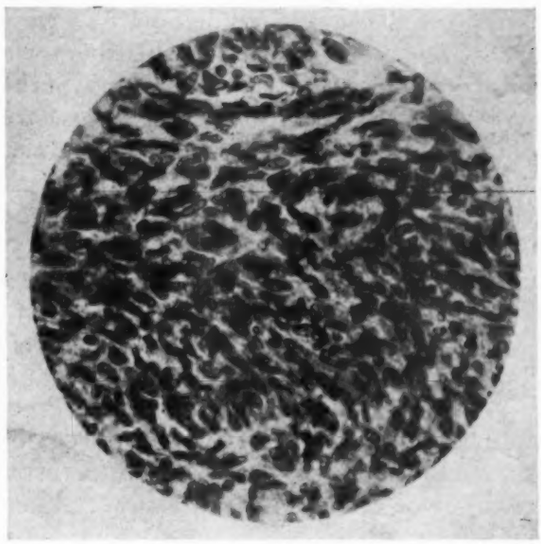

FIG. 3. Case VII. Malignant leiomyoma of the rectum; section shows a malignant growth composed of round and spindle fibroblastic cells.

MALIGNANT LEIOMYOMA OF THE RECTUM

CASE VII. E. W. D., a sixty-four year old white female, was admitted in December, 1940, stating that she had noted rectal bleeding for the past month accompanied by bearing-down pain in the rectum. She had had one massive hemorrhage requiring hospitalization and transfusions. She had a history of hemorrhoid trouble for many years and apparently a hysterectomy was done thirty years before, after which she did not menstruate.

Examination revealed a freely movable cervix but the fundus was not outlined. Insertion of the speculum was impossible. Rectal examination showed a large, smooth, globular tumor on the anterior rectal wall invading the rectovaginal septum. The surface was smooth except for the upper reaches of the tumefaction where the mucosa was ulcerated and bled easily on manipulation. Biopsy revealed a malignant leiomyoma. (Fig. 3.) The patient was treated with irradiation factors as follows: 200 K.V. machine, anterior and posterior pelvic ports, field size 20 by 20 cm., 80 cm. T.S.D., HVL 0.9 mm. Cu 300r skin dose daily for a total tumor dose of 2040r.

No change was noted and one year later resection of the tumor was attempted. No difficulty was encountered in separating the tumor from the vaginal floor but the mass was confluent with the rectum and had ulcerated through the anterior rectal wall. The tumor was found to be fixed to the base of the bladder and the pelvic peritoneal floor with marked necrosis in those areas. The tumor was removed locally. The patient's condition went downhill and she died about one month later. Autopsy revealed a malignant leiomyoma of the rectum with metastases to the liver.

The preoperative diagnosis of malignant leiomyoma (the term malignant leiomyoma is preferred to leiomyosarcoma) is seldom made with resultant inadequate and delayed treatment.[9] The symptomatology is varied although repeated spontaneous hemorrhages are of such frequent occurrence that one should be suspicious of a gastrointestinal myoma in the absence of other positive findings. The course is slowly progressive over a period of years, hence myomas are subject to standstill or regression.[6] From the uterus, esophagus, stomach and intestines this usually benign tumor can develop local and general secondary growth and prove fatal. Whether these tumors are malignant *per se* or have undergone malignant change is a moot point Gastric and intestinal myomas are apt to be associated with uterine myomas and they appear to originate from isolated segments of the musculature connected with blood vessels or epithelial structures.[6]

Our patient had a hysterectomy done

thirty years prior to admission. We were unable to ascertain whether this was for a leiomyoma. Smith in 1937 in a review of the literature was able to collect 513 cases of leiomyomas of the gastrointestinal tract. Of these, 50 occurred in the esophagus, 321 in the stomach, 109 in the small intestine and 33 in the colon.[18]

Eighty-three per cent of the leiomyomas of the large bowel arise in the rectum and because of the relative avascularity, changes occur in the gross structure.[9]

The growth may develop in any direction, hence the mucosa overlying the tumor is commonly ulcerated. However, in rectal leiomyomas this is not always so. When metastasis occurs, it is most commonly found in the liver.

Radiation therapy has no appreciable effect in the treatment of malignant leiomyomas. Radical surgery, for example, abdominoperineal resection or any of its modifications, is recommended in the nonpedunculated type of tumor since any other surgical procedure carries with it the danger of recurrence. In any event, however, the cure rate is poor.

LYMPHOSARCOMA OF THE RECTUM

Lymphosarcoma of the gastrointestinal tract is rare. The areas involved are usually the stomach, lower ileum and rectum.[6] The tumor predominantly affects men and is found most commonly in the first four decades. According to Rankin and Chumley the clinical diagnosis of lymphosarcoma of the rectum is rarely suspected before operation and rarely recognized before histologic study has been made since there are no salient features which distinguish it from other tumors in this region.[15] In their series of eighteen cases, thirteen lymphosarcomas were in the cecum, one in the descending colon, one in the sigmoid and three in the rectum. Raiford reviewed a series of forty five cases of lymphoid tumors of the gastrointestinal tract.[14] The distribution was as follows: thirteen were in the stomach, one in the duodenum, nineteen in the ileum, eleven in the colon and one in the rectum. The average age was forty-one. Sutton states that the tumors are apt to be located in the lower part of the rectum, develop rapidly[21] and, although large in size, the mucous membrane moves over them.

Ewing observed that in the origin of lymphosarcomas two specific cells participate giving rise to two forms of the tumor:[6] (1) the large round cell or the reticulum cell sarcoma and (2) the small round cell or malignant lymphocytoma. In our series we had one of each.

Before a diagnosis of lymphosarcoma can be definitely established, chronic inflammatory processes and benign lymphoid tumors must be ruled out.[20] Ewing states that in the gastrointestinal tract lymphosarcomas may resemble infectious granuloma.[6]

The question of whether lymphosarcoma is of unicentric or multicentric origin is interesting. Certainly it is true that when confined to the gastrointestinal tract it is ofttimes solitary and amenable to surgery with a favorable prognosis. However, the possibility of future involvement elsewhere does exist, hence we should be certain whether the tumefaction is primary or part of a generalized lymphomatous process. Warren and Lulenski state that neither the type of lymphoid tumor nor the location causes any significant variation from the average prognosis. The average survival in their series of twenty-eight solitary lymphoid tumors of the gastrointestinal tract was 2.5 years.[21]

CASE VIII. G. T. O., a forty-one year old white male, was admitted in December, 1944, with anal itching for one year and a history of an anal ulcer which he thought was a hemorrhoid. The lesion had been removed elsewhere in December, 1944; and since the diagnosis of lymphosarcoma was made, the patient was referred to the Institute.

Examination revealed a well developed and nourished white male. Rectal examination showed two distinct areas of ulceration involving the anal orifice. Biopsies were taken from both areas. No other abnormalities were noted nor was peripheral adenopathy seen. The liver and spleen were not palpable. The

pathologic report on the previously reviewed tissue and on the section done here was lymphosarcoma, lymphoblastic type. (Fig. 4.)

The blood counts and chest x-rays were essentially negative. The patient was treated with external radiation therapy with the following factors: 200 K.V. machine, 50 cm. T.S.D., 8 by 10 cm. field size over anus, 0.9 mm. Cu HVL, 300r skin dose daily for a total tumor dose of 2,340r. The patient was last seen June, 1947. There was no recurrence and he was feeling extremely well.

CASE IX. E. C., a forty-three year old colored female, was admitted in July, 1946. She stated that her trouble began in 1942 with anal itching. She passed blood via rectum. She had had two operations for fistula-in-ano in 1945 and 1946. A histologic section from one of the operative procedures proved to be a lymphosarcoma of the rectum, small cell type, and the patient was referred to us.

Physical examination revealed a well developed, well nourished, colored female. Rectal examination showed an indurated area on the left and anterior aspect of the anal canal and lower rectum from which a section had been previously taken. No other abnormalities were noted and the rest of the physical examination was essentially negative. The patient had a negative Wassermann but no Frei test was done. Her original blood count was normal and showed 35 per cent lymphocytes and 5 per cent monocytes. Her last count in March, 1947, showed 67 per cent lymphocytes and 2 per cent monocytes.

The patient was treated with irradiation therapy (factors as in Case VIII), with a total tumor dose of 1711r. She was last seen in 1947 at which time there was no tumefaction present although the itching still remained. Liver and spleen were not felt and patient had no peripheral lymphadenopathy. Her chest x-rays have been consistently negative.

In both cases anal itching was a dominant symptom and the diagnosis was made histologically, not anticipated clinically. Since both patients were seen elsewhere initially, we have no adequate record of the description of the original tumors. There are no definite criteria which would help establish the clinical diagnosis of lymphosarcoma. However, the finding of a large rectal mass in a patient in relatively good health is pertinent.

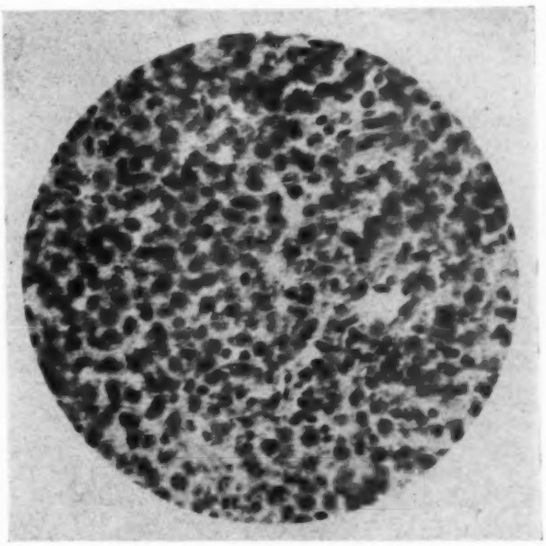

FIG. 4. Case VIII. Lymphosarcoma of the rectum; section shows a diffuse overgrowth of cells of the lymphocytic type.

Warren and Lulenski state that an extensive tumor which does not greatly distort the organ or involve the serosa is very likely to be of a lymphoid nature.[22] These lesions respond to irradiation as lymphosarcomas do elsewhere in the body. The ultimate prognosis is still guarded as too short a time has elapsed since treatment was given.

SYNCHRONOUS CARCINOMAS OF ANUS AND RECTUM

The occurrence of multiple tumors has been the subject of many statistical studies. Double and even triple primaries are by no means infrequent.[17] Tumors have been observed simultaneously in the uterus, ovaries and breasts, a combination suggesting the influence of the functional relationship existing between these organs.[6] It has also been assumed that tumors have a greater tendency to arise in areas bordering on differing histologic phases than elsewhere. Nevertheless, the probability of multiplicity may at best be only an accidental occurrence.[6] Others believe that they occur more frequently than could be expected on mere chance alone.[17,22] When we encounter

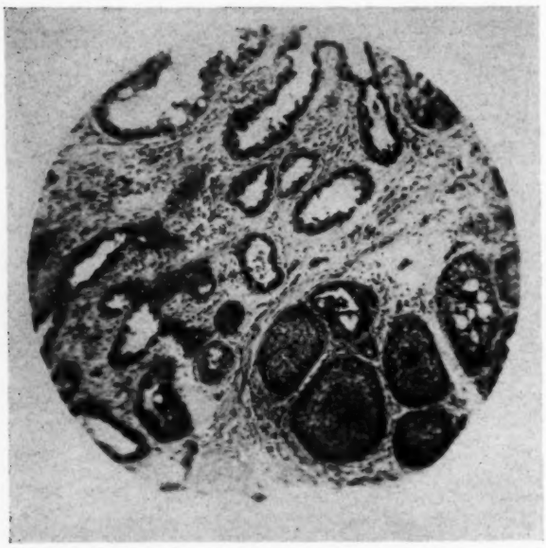

FIG. 5. Case x. Synchronous carcinomas of anus and rectum; section shows an adenocarcinoma of the rectum with a squamous cell carcinoma below.

bulky neoplasms involving contiguous organs, a secondary primary growth may be overlooked.[23]

Billroth is credited with reporting the first case of multiple primary carcinoma in 1879. Among 11,212 cases at our Institute Schreiner and Wehr found 421 (2.7 per cent) multiple tumors of which 307 were in the skin.[16] Warren and Gates state that on the basis of all statistics the frequency of multiple malignancy is 1.84 per cent of cancer cases; in their series of 1,078 cancer autopsies the frequency was 3.7 per cent.[22]

Many neoplastic diseases are assumed to be of multiple origin, for example, the lymphomas, multiple myelomas, Kaposi's disease, etc., but the basis of origin of the vast majority of cancers is still unsolved.

In reviewing Warren and Gates we note that they mention only four cases of synchronous carcinomas of the anus and rectum, hence we have added this case because of its rarity. In addition this patient also presented a third carcinoma, namely, a squamous cell carcinoma of the cervix.

CASE X. R. W., a fifty-four year old white female, was admitted to our Institute in April, 1943. She was a gravida 7, para 4. Her last three pregnancies terminated in spontaneous abortions during the first trimester. Her menopause occurred in 1942. In March, 1943, the patient had a vaginal hemorrhage and watery discharge. She also complained of constipation for one year with abdominal pain and cramps and the presence of hemorrhoids for two to three years, with the occasional appearance of bright red blood from the rectum. The patient saw her family doctor in March, 1943, at which time biopsy of a rectal tumor which was submitted to our laboratory revealed an adenocarcinoma of the rectum and a squamous carcinoma of the anus. (Fig. 5.) The patient was then referred to us.

Digital examination revealed an indurated area in the anorectal region but no masses. Pelvic examination revealed a torn, indurated and nodular cervix with an enlarged uterus. Dilatation and curettage and cervical biopsy revealed endometritis and an epithelioma of the cervix, grade II.

The patient was then given 3,600 mg. hr. of radium as treatment for the carcinoma of the cervix, and 3,030r as treatment for the anorectal neoplasm. The factors of the latter treatment were as follows: 200 K.V. machine, 70 cm. T.S.D., 10 by 15 cm. ports, 0.9 mm. Cu HVL, 300r skin dose daily for the total tumor dose as indicated.

The patient has now been followed for four years with no evidence of recurrence of any of the carcinomas.

RETRORECTAL OR SACROCOCCYGEAL TERATOMA

The term teratoma has a restricted application to a group of tumors composed of recognizable tissues and complex organs derived from more than one germ layer. In the teratoma there is a notable lack of ordinary arrangement of fetal and adult tissues and the tissues may be adult or embryonal in type.[6]

In the sacrococcygeal region the abnormalities resulting from embryonal disorders give rise to fistulas, cysts and tumors.[6] Sacrococcygeal tumors have a rather constant retrorectal position just anterior to the sacrum.[12] Therefore, small teratomas can be extirpated with relative ease. Early and complete excision of these tumors is indicated as a prophylaxis against malignant change.[5] The teratomas vary in size.

They may be entirely intrapelvic and protrude but slightly from the pelvis or follow the line of least resistance and grow outward; the latter is more common. Externally visible tumors noted at birth make early diagnosis and adequate treatment feasible. If left unnoticed because of their location or inadequate routine rectal examination, symptoms of compression of pelvic structures may develop in adult life as the result of sudden growth activity. They are not usually associated with motor or sensory disturbances, however.

Most of the teratomas contain both solid and cystic portions. There are various theories promulgated to account for the development of teratomas. No single mode of origin of sacral teratomas can be adduced. However, Ewing states that the most highly developed of the sacral tumors are fetal implantations while others probably represent formation of partial reduplication or are of strictly local origin.

Case xi. A. F., a thirty-one year old white female, was admitted to our Service September, 1942. She was a gravida 4, para 5 (one set of twins). History revealed an appendectomy and salpingectomy in 1940. She had postcoital bleeding since. From August, 1942, until her admission the patient had had daily vaginal bleeding with lower abdominal cramps. She had a history of vaginal hemorrhage in 1940 without genitourinary or rectal complaints.

Pelvic examination revealed an erosion of the anterior lip of the cervix and enlargement of the uterus. Rectal examination was negative.

Dilatation and curettage were done and a biopsy of the cervix taken. A diagnosis of adenocarcinoma of the uterus with cystic cervicitis and erosion of the cervix was made. The patient was treated with radium applicator in the usual manner.

She was followed routinely and in March, 1943, a digital examination of the rectum revealed a circumscribed, smooth, globular, perirectal tumor mass about the size of a hickory nut palpable on the posterior aspect of the lower rectum. The mucosa was intact with no ulceration or induration. The patient had no rectal complaints at this time and it is difficult to tell whether this mass had been overlooked in her original examination.

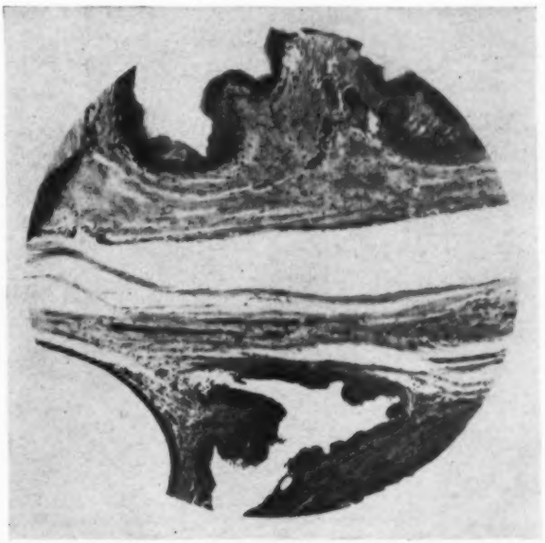

Fig. 6. Case xi. Teratoma, retrorectal; low power photomicrograph showing cystic cavities lined by columnar cells.

On April 6, 1943, under spinal anesthesia the cystic retrorectal mass was easily dissected free from the sacrum and removed *in toto*. The operative specimen measured 4 cm. in diameter, was cystic and revealed on section sebaceous material. The postoperative diagnosis was teratoma which was confirmed on histologic section. (Fig. 6.)

The patient was last seen April, 1947, with no complaints. Rectal examination was negative for any palpable tumefaction.

Since at least three men examine patients on admission to our clinic, it is hardly likely that all three would have overlooked a 4 cm. retrorectal tumor. We must assume, therefore, that it grew to palpable size in a period of six months yet was unaccompanied by any symptoms and only discovered on routine rectal examination.

SACROCOCCYGEAL CHORDOMA

Sacrococcygeal chordoma is a neoplasm probably arising from the cellular remains of the notochord and, therefore, is composed of epithelial tissue. Chordomas occur rarely, are usually encountered in the fifth decade of life and are twice as prone to develop in males as in females.

Most chordomas are presacral but they may occur elsewhere along the vertebral

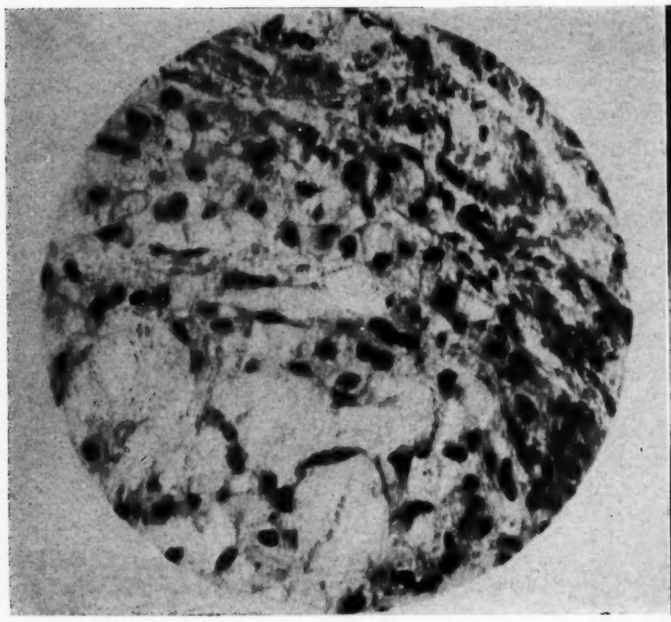

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FIG. 7. Case XII. Sacral chordoma; section shows a tumor made up of large cells with indistinct cytoplasmic border together with some vacuolization.

FIG. 8. Case XII. Sacral chordoma; roentgenogram of the pelvis showing absence of the coccyx with bone destruction and expansion of the sacrum.

column. While trauma is often considered an etiologic factor, it is still a moot point. It is known, however, that the majority of these tumors has been present for years before the patient comes for treatment.[3]

The tumors were first reported in 1858 by Virchow. The first recorded cases of clinical interest were those reported by Feldman[7] and by Mazzia[11] in 1910. Recently Gentil and Coley reviewed the published records of 128 cases and added seven of their own.[8]

The gross anatomy of these tumors is variable, particularly in the different phases of chordoma.[6] The tumors grow slowly, hence may be asymptomatic. Some, however, may grow large and protrude into the pelvis, interfering with bladder and rectal functions. When there is erosion of bone and infiltration of nerve trunks, pain is usually present. At times the rectum may be encased in a firm, gelatinous mass and perforation of the gut may occur. Usually, however, the tumors are soft, grow slowly, have an extremely low rate of cure and tend to recur locally and metastasize late in the disease.

A retrorectal tumor displacing the rectum anteriorly with positive roentgenographic evidence of sacral destruction in a patient with an antecedent history of trauma should make one suspicious of chordoma.

Radical excision at the time of the initial operation with the use of the cautery knife for the cutting of all soft tissue followed by baking the bone margin after the removal of all diseased bone is advocated by Brindley.[3] Gentil et al. believe that since radiation therapy and even radical surgery are not curative, the most that can be hoped for is palliation.[8]

CASE XII. H. S. S., a sixty year old white male who had been a carpenter for thirty years, was admitted to our hospital in December, 1940. He stated that two years previously while working on a ladder he fell, striking the end of his spine. He began having pain in the sacrococcygeal area with a peculiar pain in the rectum. This became progressively worse until he was unable to sit or bend without considerable discomfort. In November, 1940, he apparently had an operation in which the coccyx was removed. A slide was submitted to

our pathology laboratory and a diagnosis of chordoma was made. (Fig. 7.) The patient was then referred to us for treatment.

Examination of the patient revealed a 6 inch incision over the sacrococcygeal area. Digital examination showed a large, nodular tumor mass in the posterior wall of the rectum. The mucosa was intact and no ulceration was visible anywhere. Roentgenograms revealed the absence of the coccyx and an expanding tumor extending into the sacrum with partial destruction of the lower half of the bone. (Fig. 8.)

The patient was treated with the million volt machine. The factors were as follows: 15 cm. T.S.D., 15 by 15 cm. field size, 300r skin dose daily for a total of 2900r tumor dose. The patient's tumor mass did not regress; he developed a cord bladder, was incontinent and also had diarrhea. He was last seen in May, 1943, at which time the tumefaction increased in size, the rectal and urinary symptoms were still present and sacral destruction was still continuing. He died elsewhere in October, 1943, and necropsy findings revealed a sacrococcygeal chordoma with no metastases.

CONCLUSION

Unusual tumors which can be palpated on digital examination of the rectum are presented.

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UNILATERAL SPINAL ANESTHESIA FOR SURGICAL REDUCTION OF HIP FRACTURES

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SPINAL analgesia is desirable in orthopedic operations because it permits free use of the fluoroscope without the hazard of administering anesthesia in the dark and without the danger of anesthetic explosion. Usually the complete muscle relaxation provided by spinal is an aid to the surgeon. We used unilateral spinal anesthesia for every hip fracture treated surgically in this hospital in a fifteen-month period (1946 to 1947). This paper is a report of the results in the 116 operations performed in that time.

Our spinal technic is designed to localize the drug to the nerve roots supplying the affected hip. This is accomplished by weighting the pontocaine with dextrose, using a small dose and minimizing dispersion by slowly injecting a small volume. The affected side is kept dependent for ten minutes or more so that the bulk of the drug will gravitate to that side.

METHOD

The details of our method[1] are as follows: Give 20 mg. of d-desoxyephedrine intramuscularly. Place the patient in the lateral position with the affected hip dependent. Prepare a solution of pontocaine "Niphanoid" in 10 per cent dextrose so that 0.1 cc. contains 1 mg. of pontocaine. Withdraw 0.25 cc. to 0.5 cc. (2.5 to 5 mg. of the drug) of this solution into a 2 cc. syringe and add to it the contents of a 1 cc. ampule of ephedrine sulfate containing 50 mg. of the drug. Inject the contents of the syringe subdurally between L_3 and L_4 as slowly as possible with no further dilution and without barbotage. The injection should take two minutes or more. The table or bed should be level throughout. Keep the patient lying on his affected hip for at least ten minutes and as much longer as is possible until the position must be changed for the start of the procedure.

Our experience agrees with that of Dripps and Demming[2] that the routine use of d-desoxyephedrine prophylactically gives a lower incidence of spinal hypotension. No untoward reactions have occurred which could be attributed to the use of this pressor drug.

The addition of subdural ephedrine prolongs the anesthesia but adds to the time between injection of the agent and onset of anesthesia. Without this drug the anesthesia with such small doses will not consistently last more than one hour.[1] Using it in the manner described we have had satisfactory anesthesia for as long as four hours in the one leg.

As our experience with this method increased, the dose of pontocaine decreased. We now ordinarily use 3 mg. for open or closed reductions of fractured hips. In debilitated old people we have successfully used 2.5 mg. and in better risk patients we go as high as 5 mg. Completely unilateral anesthesia does not always result but motor control of the normal leg is almost always maintained while the complete motor paralysis expected of spinal anesthesia is present in the affected leg. This relaxation makes open or closed reduction easier and muscle retraction less traumatic.

The blood pressure and pulse must be closely watched from the time the spinal is given until the end of the operation. In open reductions aqueous fluids are started intravenously before surgery. Plasma or whole blood is added when a change in pulse rate or a fall in blood pressure indi-

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cate the need. In closed hip reductions these intravenous fluids are given at the first indication of circulatory difficulty.

Open reductions of the hip in this series were cases in which internal fixation was used under direct vision. Closed reductions were those in which the fracture was reduced and then fixed with a Smith-Peterson nail under multiplane fluoroscopic guidance.

TABLE I

INCIDENCE OF PREOPERATIVE CONTRAINDICATIONS TO SPINAL IN 116 UNILATERAL SPINAL ANESTHETIC CASES

Hypertension (systolic over 160 mm. of mercury	38
Arteriosclerotic heart disease	21
Cardiac arrhythmia	17
Cardiac decompensation	13
Myocardial disease	5
Hypotension (systolic under 100 mm. of mercury)	2
Diseases of the respiratory system accompanied by decreased vital capacity	26
Secondary anemia	27
Diminished kidney function (blood urea nitrogen over 20)	20
Psychic disturbance including senility	15
Psychosis	6
Degenerative disease of the nervous system	5
Dehydration	3
Increased intra-abdominal pressure	1
Anatomic abnormality of the vertebral column	1
Advanced age (over 60)	97

Since fractured hip is primarily an injury of old age, the physical condition and operative risk in these patients is of paramount importance to the method of anesthesia. Ten (8.6 per cent) of the patients were classified as good risks, twenty-two (19 per cent) were fair risks while eighty-four (72.4 per cent) had incapacitating organic disease which put them in the poor risk category. That the reader may better visualize these patients we have tabulated the incidence of some conditions which are often accepted as contraindications to spinal analgesia. (Table 1.) Here it will be seen that 83 per cent of the patients were over sixty years of age and 18 per cent suffered from psychosis or psychic disturbance. Eighteen per cent had arteriosclerosis which was diagnosed, 15 per cent exhibited cardiac irregularity and 11.2 per cent were in frank cardiac decompensation. Thirty-three per cent had systolic blood pressure over 160 mm. of mercury. The total number of contraindications far exceeds the total series because so many of the patients presented more than one.

RESULTS

In all but one of the 116 operations the anesthesia was satisfactory from both the surgical and the anesthetic standpoint. No deaths were attributed to the anesthesia by surgeons or anesthesiologists; there were no table deaths. Adriani[3] has listed the complications of spinal anesthesia; in Table II we have enumerated their incidence in this series. The only one of any frequency was spinal hypotension which occurred in twenty patients or 17 per cent. It was successfully combatted in every case with intravenous fluids and ephedrine in doses of 25 mg. or less given intravenously. We have included every case which required the administration of additional pressor drug after the spinal anesthetic was injected since it is not possible to define spinal hypotension accurately in the same way for every individual. It was judged on the relationship to preoperative blood pressure rather than on a fixed number of millimeters of mercury fall.

TABLE II

ANESTHETIC COMPLICATIONS IN 116 UNILATERAL SPINAL ANESTHETIC CASES

Hypotension	20
Respiratory failure	0
Palsies	0
Meningitis and meningismus	0
Headache	1
Nausea and emesis on table	0
Backache	0

The anesthesia was of sufficient duration in all but four cases; supplements of nitrous oxide and oxygen were given to these patients. During two operations psychotic patients were noisy. Additional sedation was required for them.

Because estimation of surgical mortality in hip fracture is difficult due to the prolonged convalescence in these aged patients, we have arbitrarily selected the first thirty days after operation for the period of surgical mortality. All patients in this series were kept in the hospital for more than thirty days so that our follow-up

for this period is complete. This would not be so for a longer one. On this basis our operative mortality was 20.5 per cent (twenty-four patients). All deaths occurred in patients over seventy years of age.

hip fractures treated surgically under the various anesthetics in a similar period were due to these same causes. It is evident, then, that death under unilateral spinal anesthesia is due to much the same causes as in a series of patients anesthetized in various ways.

TABLE III

OPERATIONS AND THIRTY-DAY FATALITIES BY AGE UNDER UNILATERAL SPINAL ANESTHESIA

Age in Years	10–19	20–39	40–49	50–59	60–69	70–79	80–89	90–99	Total	Percentage Fatality
Open reduction										
No. cases	0	1	0	9	12	19	16	3	60	
Deaths	0	0	0	0	0	7	8	2	17	28.3
Closed reduction										
No. cases	3	0	1	5	10	21	13	3	56	
Deaths	0	0	0	0	0	2	2	3	7	12.5

The operations in each age group and the number of deaths by operation and age are shown in Table III. In Table IV we have set down the causes of death and the time of its occurrence. We believe that the two pulmonary embolus deaths on the day of operation must have come from thrombi present before operation but not diagnosed and do not consider them attributable to the spinal anesthetic. The patients who were given unilateral spinal did well postoperatively.

CASE REPORTS

CASE 1. S. R. was a seventy-one year old white female who had an intertrochanteric fracture of the right femur. Her preoperative temperature, pulse and respiration were 98°F., 96 and 24, respectively, with a blood pressure of 140/70. Her heart and lungs were normal but she was debilitated and suffered from senile psychosis. Chemical hemoglobin was 12 Gm. and she was classified as a poor risk. Figure 1 shows her course during open reduction and Thornton plating. Postoperatively a urinary tract infection developed which was successfully treated with penicillin and on the fifteenth postoperative day the patient was free of any sequellae.

Four months after the patient's operation, although her general condition was satisfactory,

TABLE IV

CAUSE AND TIME OF DEATHS OCCURRING WITHIN THIRTY DAYS AFTER UNILATERAL SPINAL ANESTHESIA

	Operative Day	1–3 Days	4–9 Days	10–19 Days	20–30 Days	Total Deaths	Per Cent of Deaths
Bronchopneumonia	0	1	3	4	4	12	50
Cardiac failure	0	0	3	0	2	5	21
Pulmonary embolus	2	0	1	2	0	5	21
Cerebral accident	0	0	0	1	0	1	4
Gastric hemorrhage	0	0	0	0	1	1	4

The common causes of death in hip fracture are bronchopneumonia and cardiac failure. Table IV shows that 71 per cent of the deaths in the first thirty days after operation were due to these conditions. In checking back we found that 70 per cent of the thirty-day postoperative deaths in

she was still in the hospital because of pain in the hip.

CASE II. C. B. was an eighty-four year old white female who sustained an intracapsular fracture of the left hip. Her preoperative temperature pulse and respiration were 98°F., 96 and 20, respectively, and the blood pressure was 170/110. Her lungs were clear but she was malnourished, dehydrated, blind and senile. She had hypertensive cardiovascular disease and a failing heart with a functional capacity of II A. Her record during closed reduction of the hip and bilateral superficial femoral vein ligation is given in Figure 2. Postoperatively

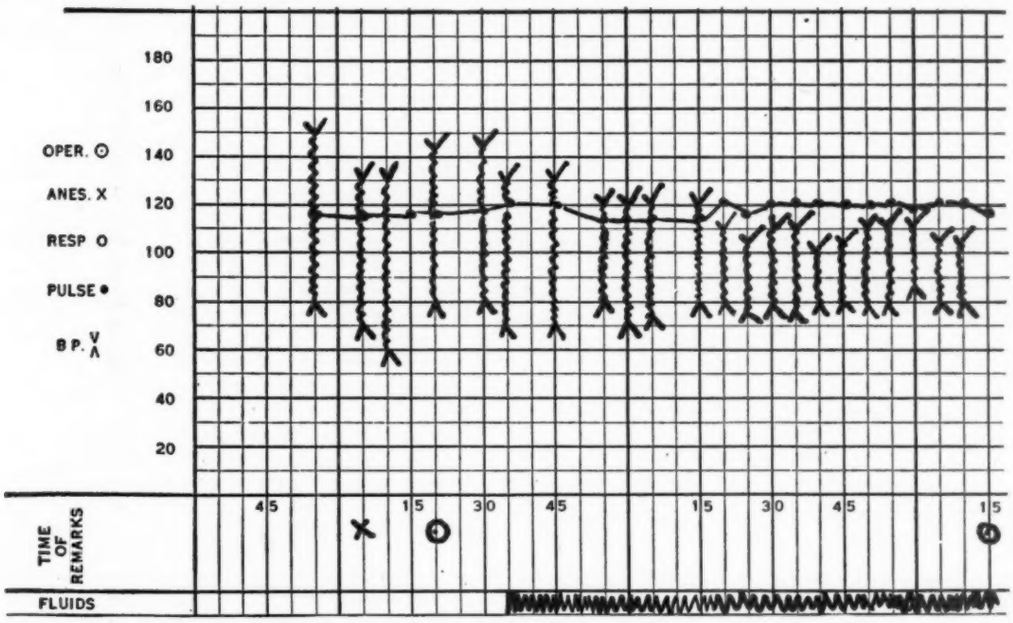

FIG. 1. Case 1. Graphic anesthesia record; spinal anesthesia to D-10 on the right and L-1 on the left. Doses: pontocaine 3 mg. in 0.3 cc. 10 per cent dextrose and 50 mg. 5 per cent ephedrine; 20 mg. of d-desoxyephedrine were given intramuscularly with the spinal and 500 cc. of blood were transfused during the operation.

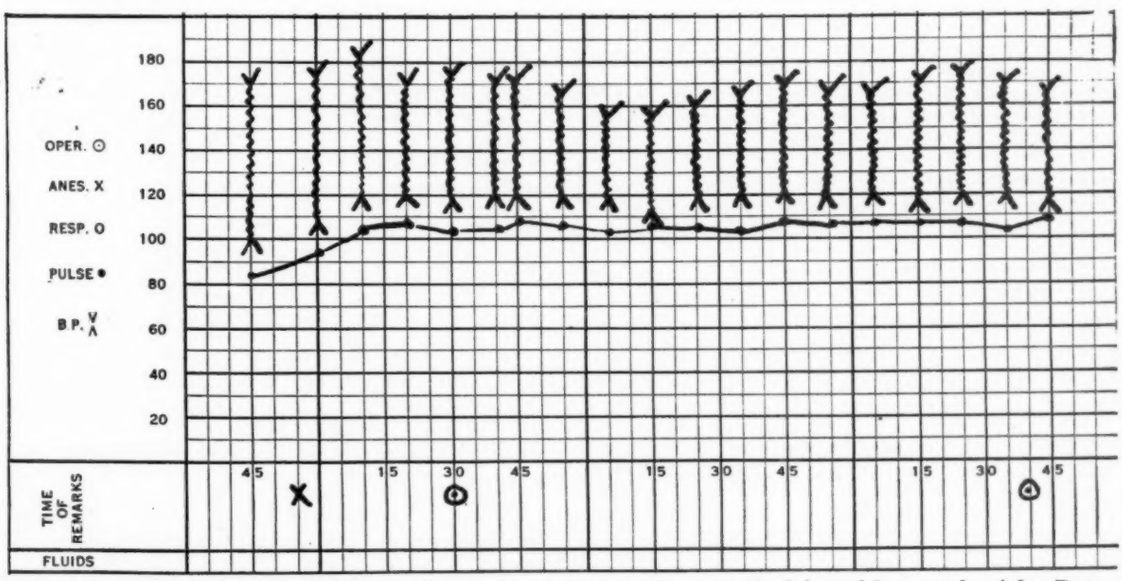

FIG. 2. Case II. Graphic anesthesia record; spinal anesthesia to D-12 on the left and L-2 on the right. Dose: pontocaine 3 mg. in 0.3 cc. of 10 per cent dextrose and 50 mg. of 5 per cent ephedrine; 20 mg. of d-desoxyephedrine were given intramuscularly with the spinal.

she had ileus which was relieved with a rectal tube and an enema. On the eighth day after operation she was up in a chair. She was taken home by her family one month after operation.

CASE III B. H. was an eighty-four year old white man with an intertrochanteric fracture of the right hip. His preoperative temperature, pulse and respiration were 98°F., 60 and 24, respectively. Chemical hemoglobin was 11.3 Gm., red blood count 4,000,000, blood sugar 94 and the blood urea nitrogen 16. Blood pressure was 205/75 and the electrocardiogram showed myocardial degeneration and extrasystolic arrhythmia. The heart was enlarged and there were mitral and aortic systolic murmurs. His record during open reduction with insertion of a Neufeld plate is shown in Figure 3. Postoperatively he did well except for urinary incontinence the first two days. He was discharged from the hospital on crutches a little more than three months after the operation.

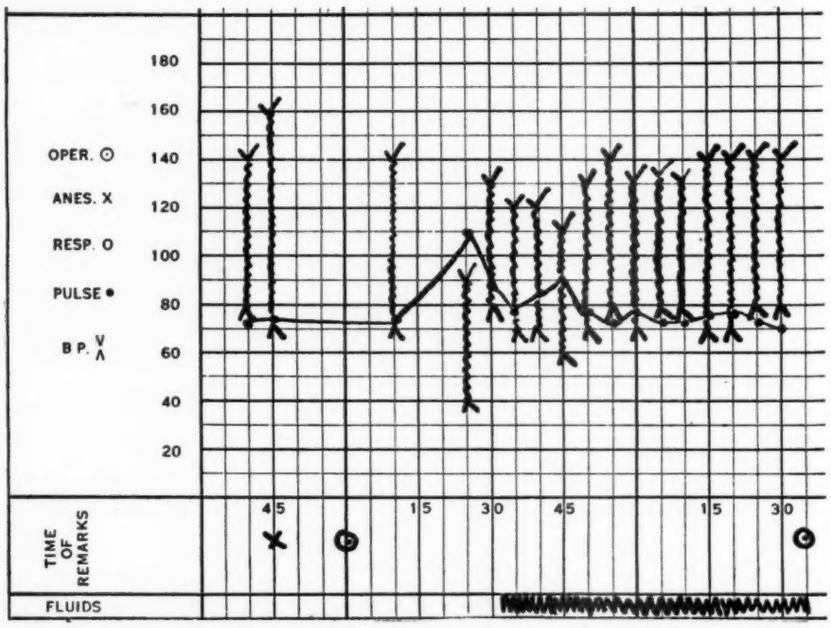

FIG. 3. Case III. Graphic anesthesia record; spinal anesthesia to D-10 on the right and L-2 on the left. Dose: pontocaine 2.5 mg. in 0.25 cc. of 10 per cent dextrose and 50 mg. 5 per cent ephedrine. No prophylactic vasopressor given; ephedrine, 25 mg. of 5 per cent solution, was injected intravenously twice during the procedure; 750 cc. of 5 per cent glucose in distilled water were infused into a vein until 500 cc. of whole blood became available twenty-five minutes before the end of the operation.

COMMENTS

The desirability of confining spinal anesthesia to the operative area is obvious and has been emphasized by many.[4–6] Our experience indicates that the minimal dose of hyperbaric pontocaine which we are using is one efficient way of doing this.

The advantages of single dose unilateral spinal anesthesia are: Minimal physiologic effects on blood pressure are noted, possibly because there is less sympathetic nerve and voluntary muscle paralysis. Small dosage will produce anesthesia of sufficient depth and duration for a procedure of almost any length. The technical difficulties of insertion and maintenance of flow of continuous spinal technics are eliminated as are the larger doses required with these and the inevitable bilateral anesthesia. The explosion hazard is eliminated and x-ray equipment may be used freely. The dangers of giving general anesthesia in the dark are avoided.

The disadvantages of the unilateral technic are: The patient must lie on his affected hip while the anesthetic is administered. Although it is painful for him to be turned into this position, the pain

diminishes as soon as he is in place on his side and disappears within two minutes or less of injection of the anesthetic solution. This factor has been of little significance in our series. The patient must be allowed to lie on his affected side for ten minutes or more before he can be positioned for operation. This entails starting the anesthetic well before the scheduled time of operation. It is sometimes difficult to do a satisfactory lumbar puncture in old people with arthritic changes in the spine who are unable to get into the best possible position because of their fractured hips, unbending backs and inability to understand or cooperate. However, we have not as yet had to change to another anesthetic for this reason.

Evidence shows that our method of spinal anesthesia does not lower the number of postoperative deaths compared to that obtained with ordinary methods in similar cases. However, we do think, and our surgical colleagues agree, that we are providing maximal relaxation without undue physiologic disturbance to the patient.

Geriatric anesthesia is never a simple problem, particularly in cases in which traumatic surgery must be done. We offer this method of unilateral spinal anesthesia as one solution, with the reservation that each anesthesiologist works best with the agent and method with which he personally is most familiar.

SUMMARY*

1. One hundred sixteen consecutive operations for fractured hip were done under a method of unilateral spinal anesthesia. The details of the method are given.

2. Seventy-two per cent of the patients were poor operative risks and 83 per cent were more than sixty years old. There were no anesthetic deaths.

3. Unilateral spinal anesthesia may be used for hip surgery in old poor risk patients without increasing the hazard of operation.

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* Since submission of this paper for publication 250 additional cases have been added to the series using the technic described. The authors are indebted to Jesse T. Nicholson, M.D. for valuable suggestions in the preparation of the manuscript.

Streamlined Articles

SURGICAL TREATMENT OF CANCER OF THE ESOPHAGUS*

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RESECTION of the esophagus offers the only possibility of cure and real palliation in this dread disease. Without radical surgery the mortality is 100 per cent. Continuity of the alimentary tract can be restored by esophagogastrostomy, esophagojejunostomy, end-to-end anastomosis of the esophagus or pharyngogastrostomy.

With increasing experience the limits of operability can be extended. However, early diagnosis is even more important than taking greater risks. Most patients die within fourteen months after the onset of symptoms, with complete obstruction occurring about the seventh month.

Every case of dysphagia with or without pain in a male thirty-five years or over, not due to proven cardiovascular disease, should be fully investigated for carcinoma of the esophagus.

Cancer of the esophagus ranks ninth in frequency among malignant tumors occurring in males beyond the age of 20 years.[2] It comprises from 5 to 8 per cent of all malignant tumors. Eighty per cent occur in the male at any time after twenty but usually between the ages of fifty and eighty, greatest in the seventh decade.

The annual mortality rate increased from 2,243 to 2,949 from 1934 to 1944, a rise of 30 per cent. Annually, 40,000 people died from carcinoma of the stomach and the esophagus is involved by direct extension in 12 to 16 per cent, increasing the mortality of carcinoma of the esophagus about 5,600.

Ninety per cent of the lesions are squamous cell carcinoma and 10 per cent are adenocarcinoma. Eighty per cent are located in the lower two-thirds of the esophagus. The degree of the malignancy is highest in the mid-esophagus,[3] local lymph node involvement and distant metastasis taking place early.[9] The lymph nodes are involved in 100 per cent of the patients operated upon. However, 20 per cent[12] to 40.7 per cent[13] of over 1,100 cases autopsied had no metastases; therefore early diagnosis and early operation can salvage a fair percentage of these cases.

* * * *

Symptoms. The onset is usually insidious. Progressive dysphagia is the most common symptom.[6] Other complaints include substernal oppression, regurgitation shortly after eating, differential ability to swallow liquids but not solids, epigastric distress immediately after eating and a sensation of pressure in the suprasternal notch. Weight loss almost always occurs but is not in itself a reliable indication of advanced disease because it may be secondary to obstruction by a small operable carcinoma or even in some rare instances, a benign tumor. Back pain, however, is of serious import, implying deep ulceration around a growth or extension into the paravertebral structures. In a patient beyond thirty-five years of age any change at all in the normal act of swallowing should arouse sufficient suspicion to invoke active diagnostic measures. As

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Johnson[7] aptly states, difficulty in swallowing should be regarded by the profession and the public in the same light as a lump in the breast. Watchful waiting should be abandoned. Haste is important. Physical examination is relatively unimportant.

Diagnostic Measures. Any patients, particularly males over thirty-five, having the aforementioned symptoms should have roentgen studies by a competent examiner. Roentgen examination is extremely important; fluoroscopy and films usually show narrowing of the lumen with irregular filling defects and varying degrees of proximal dilatation due to obstruction.

Differential Diagnosis. Similar symptoms are encountered in the following: cicatricial stenosis (usually due to swallowing of lye), cardiac spasm, reflex spasm, peptic ulcer and diverticula. Ulceration may rarely be due to tuberculosis, syphilis or typhoid.

Complications. Periesophagitis, suppurative mediastinitis, perforation of the trachea, bronchi or lungs with aspiration pneumonia, lung abscess or pulmonary gangrene may occur or perforation of the aorta with dangerous hemorrhage.

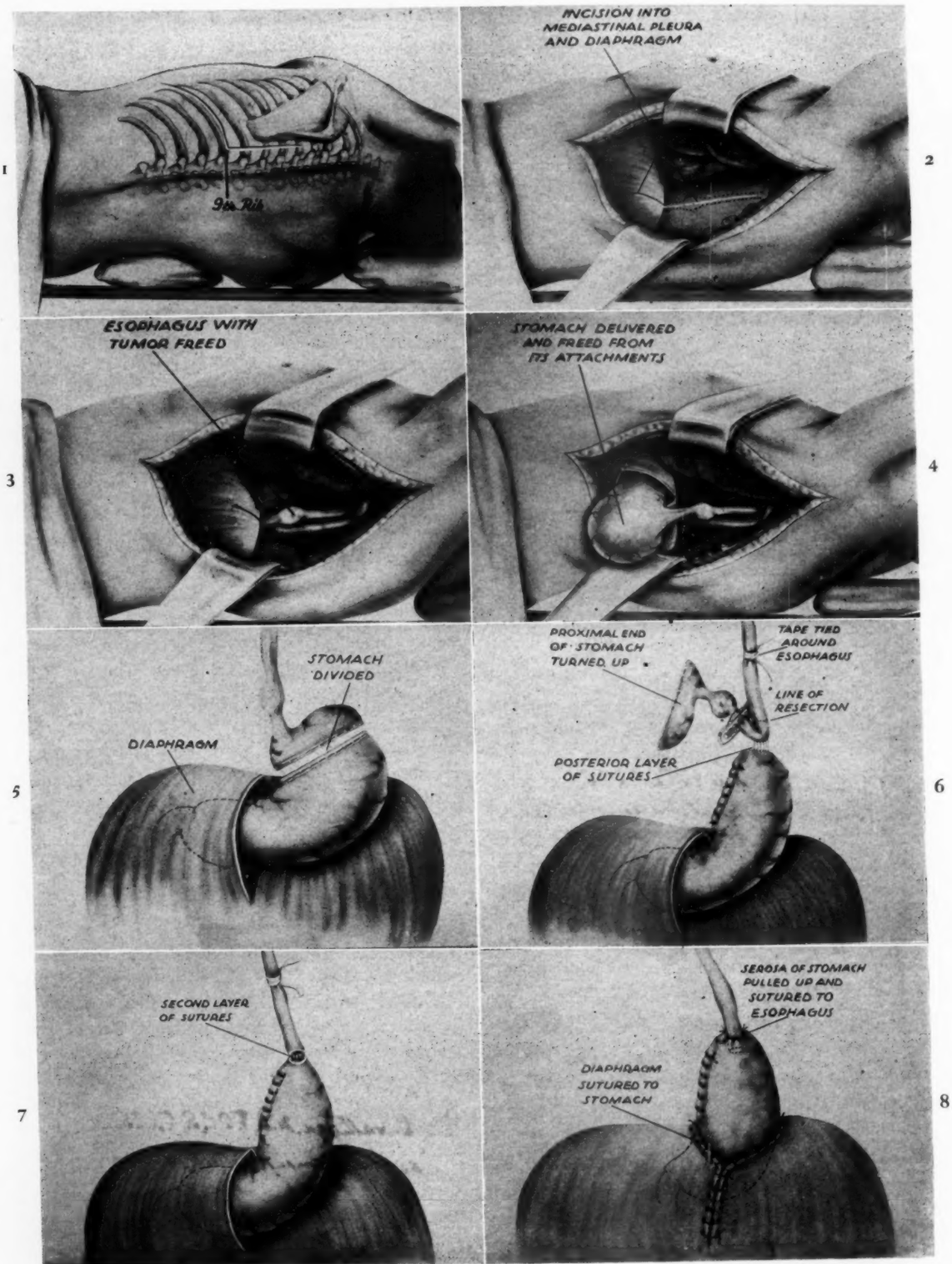
Mortality. The statistics of Garlock[20] show the average patient with cancer of the middle third stands a 54 per cent chance of surviving the operation and a 30 per cent chance of living over a year. Cancer of the distal third gives the patient a 70 per cent chance of surviving the operation and almost a 100 per cent possibility of living over two years. In adenocarcinoma of the cardia the probability of operability is only about 37 per cent. There is a 60 per cent chance of operative survival and an 80 per cent probability of living over a year in the operable cases. However, the operability percentage (now about 63 per cent) as well as the mortality rate and the postoperative survival period will be markedly improved when more early patients are referred for operation and more skill and experience are gained in operative management.

Our own series of thirty-four cases of carcinoma of the esophagus includes eight cases beginning in the cardia. We include cases beginning in the cardia only if they involve at least 2 inches or more of the esophagus itself. Two patients refused operation; three cases were hopeless, the patient's ages being from seventy-six to eighty years or more. X-ray showed mediastinal involvement and the patients were deemed inoperable. The rest of the patients were operated upon successfully, with two deaths. We go into this with our eyes open; most patients are bad risks not only from the standpoint of malignancy and poor nutritional state, actually a combination of starvation plus toxemia, but also they have, in addition, cardiovascular, renal, pulmonary disease, etc.

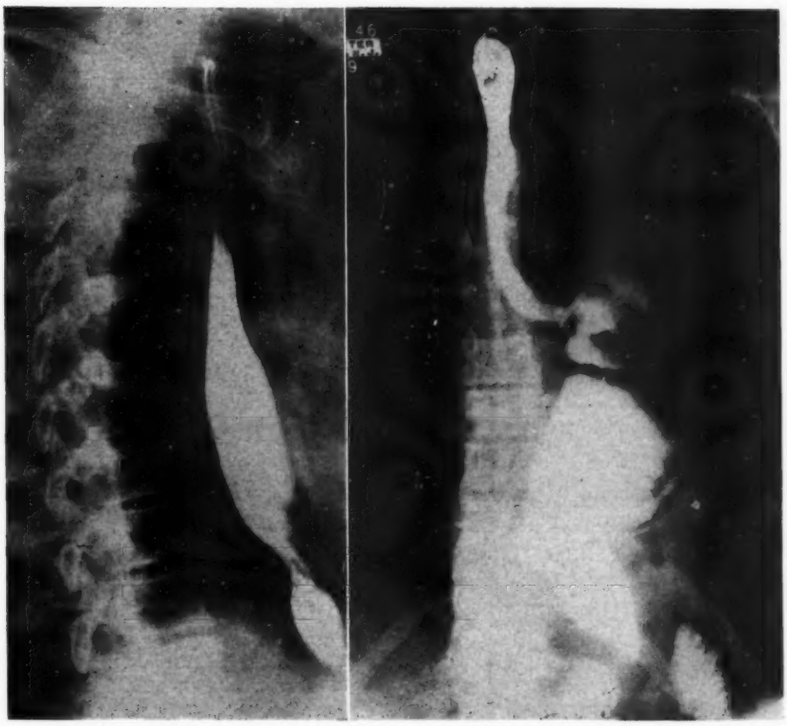
One patient died forty-eight hours postoperatively. He had a definite carcinoma of the esophagus, checked by x-ray, esophagoscopy and biopsy. He had a bilateral bronchiectasis which had been postponed twice because of acute excerbation of the infection. He was considered a bad risk by the anesthetist. He died of a massive atelectasis forty-eight hours postoperatively. One patient died two weeks postoperatively. This patient gradually deteriorated and died without any particular local symptoms except asthenia and anorexia.

CASE REPORT

J. I., a fifty year old white man who was a waiter, was first seen by one of us (L. L. P.) on January 25, 1946. He had been in perfect health up to five months previously when he began to have dysphagia to solid foods. This symptom became progressively worse and, in the two months after the onset he could not even swallow semi-solid foods. At this time he experienced lower substernal pain which radiated to the back. He also noted occasional regurgitation of food immediately after swallowing. During the five months of his illness he had lost 15 pounds. Two weeks after the onset of this illness the family physician referred him to a colleague for roentgen study of the gastrointestinal tract including the esophagus. The report was negative. Four and a half months later, January 19th, another roentgen-



FIGS. 1 to 8. The authors' procedure. In Figure 1 the incision formerly used is demonstrated. Now the incision is through the eighth interspace; the rib is usually not resected.



9 10

FIG. 9. Preoperative film showing narrowed, irregular filling defect in lower third of the esophagus causing obstruction.
FIG. 10. Postoperative film showing esophagogastrostomy with upper third of the stomach in the left chest and entire stomach assuming a vertical position.

ologist reported a definitely obstructing neoplasm in the lower end of the esophagus.

Physical examination and laboratory studies were essentially negative except for a moderate, hypochromic anemia. The patient was admitted to the Jersey City Medical Center January 29, 1946, where a roentgen study of the esophagus corroborated the diagnosis of obstructive carcinoma of the lower end of the esophagus.

Esophagoscopy and biopsy revealed squamous cell carcinoma. Resection of the esophageal lesion was decided on and the patient was operated upon February 14, 1946.

An incision was made along the left eighth rib from the costochrondral junction, posteriorly to the erector spinae and upward to the fifth rib. (Fig. 1.) The eighth rib was resected subperiosteally and the seventh and sixth ribs were cracked between their angles and their heads. The intercostal bundles were tied and cut.

An incision was then made through the periosteum of the eighth rib, following which the ribs were spread apart and the lung retracted upward and medially. The phrenic nerve was crushed over the pericardium and an incision was made over the mediastinal pleura. (Fig. 2.)

The esophagus was freed beyond its upper half and the growth was mobilized. (Fig. 3.) At this point a localized mediastinal abscess was found and about 2 ounces of pus was aspirated. The diaphragm was opened radially from the esophagus to the costal margin. Following this the greater curvature of the stomach was freed by ligation of the gastrocolic omentum and the vasa brevia. The spleen was adherent but was dissected free from the stomach and replaced into the abdomen. After doubly ligating and dividing the left gastric artery the cardia was freed from the diaphragmatic attachments and the greater and lesser curvatures were freed up to the right gastro-epiploic artery. (Fig. 4.)

A clamp was placed on the esophagus 4 cm. above the growth and a slipknot of tape was placed just above that. A Von Petz clamp was applied across the cardiac portion of the stomach which was then cut between the staples. (Fig. 5.) This was inverted with a

double layer of sutures, the inner of chromic catgut (dulox) and the outer of black silk. The cardia of the stomach and the growth were pulled upward simultaneously and the fundus of the stomach was then sewn with interrupted sutures to the posterior wall of the esophagus 4.5 cm. above the growth. Following this the growth was resected and an anastomosis performed with two layers of silk sutures. (Figs. 6 and 7.) The stomach was then pulled up in a sleeve-like manner above the anastomosis and sutured to the pleura above.

The diaphragm was closed with interrupted silk sutures and the stomach was sewed to the cut edges of the diaphragm with silk sutures. (Fig. 8.) A Mallinckrodt catheter was inserted through a stab wound in the ninth intercostal space; sulfa crystals were frosted in the pleural cavity at this point. Heavy No. 4 chromic sutures were used to approximate the ribs. The pleura was closed and the lung inflated before placing the last few sutures. The outer layers were closed with chromic catgut and the skin with silkworm gut.

Although we still continue to use this incision for carcinoma in the mid-esophagus, in the last eight cases we have used the Garlock incision for carcinoma of the lower portion of the esophagus and the cardiac end of the stomach. The latter incision gives a better exposure and permits a preliminary examination of the abdomen for extension and metastases before opening the thorax.

Figure 9 shows preoperative irregular filling defect in the lower third of the esophagus obstruction. Figure 10 postoperative film (thirteen days postoperatively) taken posteroanteriorly and laterally, shows three fluid levels and atalectasis of the lung. An x-ray taken March 1st was similar. One taken March 21st showed no fluid levels in the chest.

The pathologic report was squamous cell carcinoma, Type 1. No metastases were found in the lymph nodes.

The patient made an uneventful recovery and was discharged on March 29, 1946, able to eat a normal diet.

TREATMENT

Preoperative. All patients are carefully prepared. Fluid and electrolyte vitamin balance is restored to normal. Blood volume estimations have been of great value in determining the amount of blood to be given preoperatively; it is always greater than we would estimate clinically. Penicillin, 300,000 units in aqueous solution with procaine, is given daily for three days prior to operation. Vitamin deficiencies are corrected.

Postoperative. Fluids, transfusions and vitamins are given parentally for four days then clear fluids by mouth and, on the sixth day, soft diet. The Levine tube may or may not be used; the higher the anastomosis the more likely the tube with continuous low pressure suction is used. Oxygen is a valuable adjunct. The antibiotics, penicillin, streptomycin and sulfa drugs, are used routinely for several days postoperatively. Early ambulation is practiced.

Twenty-nine cases of carcinoma of the esophagus that were resected were reported with two deaths. One case with perforation and localized suppurative mediastinitis was successfully resected.

SUMMARY

Early diagnosis of carcinoma of the esophagus is essential. Most patients die within fourteen months of onset of symptoms. Complete obstruction usually occurs within seven months after onset.

Every case of dysphagia with or without pain occurring in a male thirty-five years of age or over, not due to proven cardiovascular disease, should be fully investigated for carcinoma of the esophagus.

Esophagectomy offers the only possibility of cure (Thorek's patient lived eleven years) and real palliation; otherwise the mortality is 100 per cent. Operative mortality ranges from 7 to 25 per cent in the best hands.

The duration of palliation ranged from six months to four years. However, those patients who do survive have real palliation and can eat and drink normally with comparative comfort. Follow-up of operations are too short to evaluate five-year cures, particularly in carcinoma of the mid-thoracic region as all cases were done since 1944.

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CAROTID-JUGULAR ARTERIOVENOUS FISTULA*

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CAROTID-JUGULAR arteriovenous aneurysm is almost invariably acquired and caused by penetrating wounds. The abnormal communication should be eliminated as early as practicable. Digital or mechanical pressure over the site of the fistula or upon the main artery proximal to the fistula should be tried for a time but not carried on indefinitely. The patient should be made aware of the possibility of cerebral complications following ligation of the common carotid artery even though the technical procedure is performed without mishap. The cerebral anemia may be temporary in some patients while in others changes of great severity rapidly ensue. The fact that such a varied circulatory reaction is brought about by a small and unimpressive local lesion has aroused the interest of investigators for many years. An extension of our basic knowledge is necessary before a thorough explanation of all the phenomena associated with arteriovenous fistulas is possible.

* * * *

This condition, recognized as arteriovenous aneurysm or fistula indicating an abnormal communication between artery and vein, is one of the most unique lesions in medicine and its fascination is characterized by certain physiologic phenomena. Although arteriovenous fistula is not unusual, it rarely occurs between the common carotid and internal jugular vein. Only sixty-five cases have been reported up to 1948.[1]

Any abnormal communication between an artery and a vein may be either congenital or acquired but the great bulk of arteriovenous fistulas are of traumatic origin. Those of traumatic origin are the result of penetrating wounds, fractured bones and severe contusions from external trauma. Technical errors during surgical procedures on large vessels have also been responsible for this vascular disorder. Rupture of an arterial aneurysm into an adjoining vein and erosion of a concomitant vessel by an abscess in the wall of a vein or an artery have given rise to spontaneous arteriovenous fistula. It is important to bear in mind that more than one arteriovenous fistula may follow a single injury.

The physiologic disturbances of the circulation in arteriovenous fistula have to a large degree been clarified by the experimental studies of Holman and others.[2–5]

General systemic changes in cases of arteriovenous fistula depend to a great extent upon the size of the fistula, its proximity to the heart and the unobstructed flow of blood through the fistula to the heart. Small fistulas have been known to produce no systemic changes. However, large fistulas, particularly those close to the heart, are usually followed by demonstrable alterations in the involved vein and artery as well as the heart.

There is a fall in general arterial blood pressure affecting both systolic and diastolic levels. The venous pressure is increased proximal and distal to the fistula, which is slight or pronounced, according to the size of the fistula. The cardiac output and pulse rate are increased. The more remote effects are a permanent diversion of part of the circulating blood from the normal capillary bed into the fistulous circuit followed by a gradual dilatation of the heart and of the artery and vein proximal to the fistula, and the development of an extensive collateral circulation due to the lowered resistance to the flow of blood

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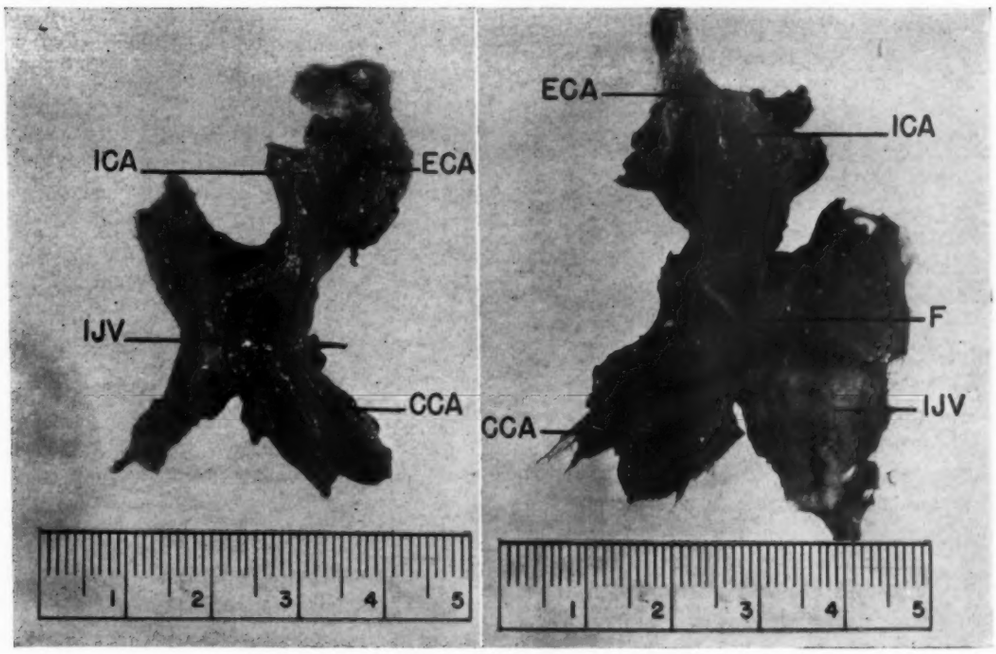

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FIG. 1. Operative specimen of unopened carotid-jugular arteriovenous fistula. IJV, internal jugular vein; ICA, internal carotid artery; ECA, external carotid artery and CCA, common carotid artery. FIG. 2. Operative specimen of opened carotid-jugular arteriovenous fistula. ECA, external carotid artery; CCA, common carotid artery; ICA, internal carotid artery; F, fistula and IJV, internal jugular vein.

at the site of the fistula. Subsequent to the closure of a fistula there is readjustment of the physiologic disturbances of the circulation.

As to physical findings, a machinery-like thrill and bruit, which are persistent throughout the cardiac cycle and which are accentuated greatly during systole and diminished greatly during diastole, may be noted at the site of the fistula.

Symptoms referable to cardiovascular changes may manifest themselves as dyspnea, tachycardia and palpitation. Headache, illusions, fainting, delirium, uncontrollable bleeding from nose and mouth, visual and hearing disturbances, aphonia and hemiplegia are peculiar to carotid-jugular arteriovenous aneurysms.

The ideal surgical procedure to produce a permanent cure of arteriovenous fistula must eliminate completely all possible channels by which blood can find its way through an abnormal communication between an artery and a vein. Six to three months should be allowed for the development of a collateral circulation. Such a period allows adequate time for the organization of the hemorrhage, the return of surrounding tissues to normal function and appearance and the disappearance of any organisms implanted in the wound at time of injury. In some cases healing will occur spontaneously. The following operative measures are available for the treatment of arteriovenous aneurysms: proximal ligature of the artery (dangerous procedure); ligation of fistula (danger of uncontrollable hemorrhage from ligature cutting through tissues); restorative procedure (not objectionable when feasible); quadruple ligature of artery and vein with complete excision of arteriovenous fistula (operation of choice when it is possible to expose the arteriovenous fistula completely); ligation of proximal vein (in cases of long standing with clinical evidence of a badly damaged heart); ligature and division of involved artery and vein with transfixion ligature of fistula (effective method in hazardous cases); closure of fistula by twisting the divided vein

(valuable procedure when it is impossible to expose the vessels distal to the communication between artery and vein).

CASE REPORT

V. E., a twenty-four year old white male, was admitted to the hospital with a gunshot wound in the left side of the neck which was blood-stained and swollen. Two smaller puncture wounds were identified on the right side of the neck. Five days later a thrill was palpated and a continuous bruit became audible at the site of swelling. Manual compression of the swelling obliterated the thrill and bruit. Operation was deferred for twelve weeks to permit the development of a satisfactory collateral circulation. During this interval the patient complained of a disturbing buzzing in the left side of his head and neck.

After an incision along the anterior margin of the left sternocleidomastoid muscle and deep cervical fascia the carotid sheath was identified and opened along its anteromedial aspect. A fistula was noted between the common carotid artery and the internal jugular vein. A thrill was readily palpable in the vein adjacent to the fistula and was obliterated following compression of the arteriovenous communication. A complete extirpation of the aneurysm with the involved portions of artery and vein was performed. (Figs. 1 and 2.) The disturbing buzzing in the left side of his head and neck, the bruit and thrill disappeared following the operation. The patient was discharged without any evidence of cerebral damage.

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ELEPHANTIASIS AND THE KONDOLEON OPERATION

A TWENTY-YEAR POSTOPERATIVE FOLLOW-UP

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A PATIENT with an advanced type of elephantiasis of the lower extremities was operated upon twenty years ago by Kondoleon's method in four stages. An unusual opportunity has been afforded to observe the result over this period of time. The occurrence of repeated streptococcal infections as the cause of non-filarial elephantiasis seems to be applicable to this case; this patient had numerous attacks of acute tonsillitis with lymph gland infections, furuncles, abscesses, bronchitis, pneumonia and chronic arthritis. Good health and an excellent anatomic result was enjoyed by the patient for fifteen years. During the past five years, however, attacks of acute inflammation had been troublesome and incapacitating, with very little change in the size of the extremities. Penicillin injections (100,000 units) every three hours for several days during the last attack caused a subsidence of the inflammation within forty-eight hours. This beneficial effect lasted for six months during which time the patient enjoyed better health and more comfort than she had in years. The result in this case after the use of penicillin has been so effective and so lasting that one is led to postulate that not only does the drug seem specific for the attacks of inflammation but also it may be a factor in eradicating the focus of the disease. Kondoleon's operation for elephantiasis is the best treatment available at the present time for these unfortunate victims. The patient whose case is reported here has been observed over a period of twenty years. Throughout this whole period of time the improvement observed immediately after operation has persisted as manifested by the accompanying photographs.

* * * *

Very little has been added to our knowledge of the cause of elephantiasis nostras since the original report of the senior author's case in 1929.[10] The pioneer work of Matas[7] in this country contributed much toward understanding the role of streptococcal infection as the cause of non-parasitic elephantiasis. He maintained that repeated bacterial invasion is essential. One may describe lymphatic elephantiasis as a chronic, progressive enlargement of a portion of the body due to hyperplasia of connective tissue of the skin and subcutaneous tissues, hyperplasia of the lymph vessels and chronic edema of the affected part.[9]

The symptoms of elephantiasis are characterized by recurrent attacks of erythema of the affected part. A chill and vomiting usually usher in the attacks. The temperature may rise even to 105° or 106°F. The part is suffused with a bright red erythema; the red area is swollen and feels brawny. Pitting on pressure is absent. Neighboring lymph glands are enlarged, swollen and tender. The inflammation of the skin subsides within a few days to a few weeks but the edema persists. The attacks recur at frequent intervals, as many as six in one year, as in this case. In the meantime there is marked hypertrophy of the connective tissue elements of the skin, subcutaneous tissues and deep aponeurosis. Thus true elephantiasis is established.

Between the attacks pain is the most constant complaint, varying within wide limits as to its severity. In some instances opiates are required for relief. However,

more commonly, if no acute attack of erythema is present, the patient only complains of heaviness of the lower extremities and difficulty in standing or walking.

TREATMENT

As mentioned before, all attempts at treating the disease up to the time of Kondoleon met with failure. Among the unsuccessful methods may be listed the following: bandaging, bed rest, radiotherapy, salvarsan, sympathectomy and Handley's lymphangioplasty using strands of silk as artificial drains in the brawny tissues.[1,8] In more recent years Gillies and Fraser[3] treated a patient with lymphedema with a skin grafting procedure, as did Macey.[6] The latter applied a skin graft to an exposed area of deep fascia and excised all superficial tissue after two weeks. However, these were isolated surgical attempts and apparently were not successful enough to warrant wider use.

In 1911 Lanz[5] of Amsterdam was the first to recognize the deep fascia as the barrier to the absorption of lymph. In order to drain the subcutaneous lymph he incised the deep fascia on the outer side of the thigh, exposed the femur behind the vastus externus and introduced strips of fascia between the muscles. Believing that bone marrow may facilitate absorption, he later placed pedicled strips of fascia into the medullary cavity through holes drilled in the bone. The skin was closed without drainage. A diminution in the size of the limb resulted and it persisted for three years after operation. However, Lanz's operation was too mutilating and too difficult to attain popularity even though it was successful to a great degree.

Kondoleon believed that small incisions into the deep fascia were inadequate since extensive lymph stasis occurred at the deep fascia. He removed wide strips of deep fascia (5 cm. to 7.5 cm.) through long lateral skin incisions upon both sides of an affected limb. Together with the deep fascia long sections of the overlying edematous fatty tissue were also removed. Thus the musculature was exposed and Kondoleon believed an anastomosis was established between the supra-aponeurotic and infra-aponeurotic lymphatics. The wounds were sutured without drainage and in such a manner that the skin, with the fat adherent to it, was brought into direct contact with the bared underlying muscles. Henry[4] disagrees with Kondoleon as to the manner in which the excess lymph is successfully drained off following operation. He believes that the superfluous lymph is absorbed by the rich vascular supply of the muscles and not by the deep lymphatics. Ghormley and Overton[2] in 1935 summarized all cases in which patients were treated at the Mayo Clinic by the Kondoleon operation, and all its variations. They also believe that the benefit from the procedure results from a direct communication between the superficial lymphatics and the vascular network of the muscles. In each succeeding modification they have endeavored to increase the communication between these two regions. The report of their postoperative results is good.

CASE REPORT

Miss T. O., a thirty-two year old silk warper, was admitted to St. John's Long Island City Hospital July 17, 1927, for relief of enormously swollen lower extremities.

The patient had varicella at six months and measles when a child. She had suppuration of the cervical lymph glands when one year old which left scars. When seven years of age she had pertussis. She suffered numerous attacks of acute tonsillitis up to 1914; in 1918 she had pneumonia. Since 1913 she had numerous furuncles and abscesses, many of which required incision and drainage. Vaccine injections were administered for this but were without any appreciable benefit. In 1925 seven teeth were extracted for apical abscesses.

The patient had lived in New York City all her life; she had never been to the tropics. In 1918 the patient was suddenly seized with pneumonia following a short illness of bronchitis. This confined her to bed for five weeks. When first permitted out of bed she noticed that her left foot and leg were swollen up to the knee. The swelling persisted.

Twenty months later the patient was stricken with ruptured appendicitis. Subsequently she noticed that the swelling of her right lower extremity increased. At the same time both lower extremities were becoming firm and hard to the touch. Bandaging and massage afforded no relief.

One year later she experienced her first attack of acute inflammation; her limbs were swollen, reddened and warm. This lasted three days. Gradually these attacks increased in frequency and severity. In 1925 there were five such attacks of inflammation, her vulva also becoming swollen and oozing serum and lymph.

She was observed in several attacks of acute inflammation with erythema. The legs and thighs were immensely swollen, reddened and warm to the touch. The inguinal glands on both sides were extremely tender and swollen. Her temperature often reached 105° and 106°F. The patient lay in bed prostrate. Warm, moist dressings, codeine sulphate and salicylates made her more comfortable. Several of these attacks lasted seven to ten days.

Throughout this time the patient continued to be troubled with furuncles and abscesses on the arms, back, etc. She was admitted to several New York City hospitals in her search for relief. Numerous examinations for filariae were made without success. Roentgen ray therapy was tried but gave no relief; bandaging was useless. Because of the increasing size of her limbs she found it becoming more difficult to walk. When operative relief was mentioned, she and her family welcomed the suggestion.

Physical examination revealed a young female, 5 feet 6 inches in height, weighing 159 pounds. Her heart and lungs showed no abnormality. On her abdomen there was a wide appendectomy scar. Her body was of the thin, slender type as far down as her hipline where a marked change took place. The thighs, legs and feet were enormously swollen; the excess tissue formed large pads and folds, especially about her knees and ankles. There was no pitting on pressure but a brawny, hard resistance was felt. (Fig. 1.)

The laboratory data was as follows: Several specimens of urine yielded only faint traces of albumin and a few hyaline casts. The stools were repeatedly negative for ova or parasites. Examinations of the blood night and day on numerous occasions were always negative for parasites; hemoglobin, 12.8 Gm.; color index, 1; erythrocytes, 4,476,000 per cu. mm.; leukocytes, 8,760 per cu. mm.; polymorphonuclear leukocytes, 53 per cent; large lymphocytes, 14 per cent; small lymphocytes, 26 per cent; mononuclears, 3 per cent; transitionals, 2 per cent; and eosinophiles, 2 per cent.

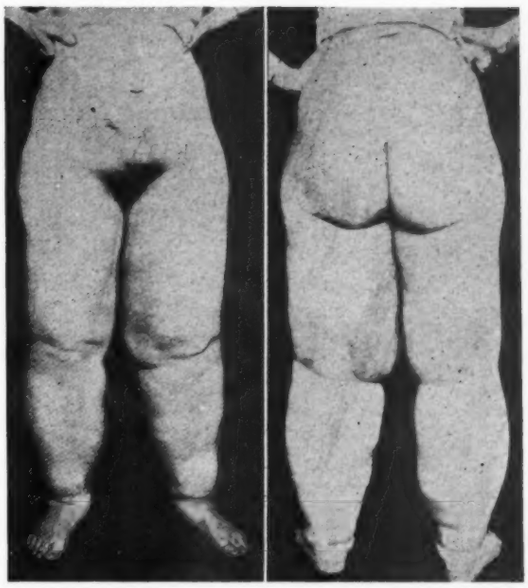

FIG. 1. Condition of patient before Kondoleon operations, July, 1927.

To correct such an extensive deformity of elephantiasis of both lower extremities, four separate Kondoleon operations were planned. On July, 1927, on the lateral aspect of the left lower limb an elliptical incision was made from the greater trochanter of the femur to just above the external malleolus, excising a strip of skin 6.3 cm. to 7.6 cm. wide and a strip of fat and deep fascia about 2.5 cm. wide. The thickness of fat was marked, attaining a depth of 7.6 cm. to 12.7 cm. Incision of the fat did not result in marked bleeding but lymph and liquified fat exuded in large quantities. The deeper layer of the fat was thickened, cicatrized to some extent and edematous, the edema being particularly evident in the popliteal space. The deep fascia was greatly thickened throughout.

After excising skin, fat and deep fascia in one maneuver the musculature, especially in the thigh region, bulged markedly into the wound. The skin edges were approximated by a continuous catgut suture, using several interrupted silkworm gut tension sutures. No tourniquet was used. Gas-oxygen-ether was administered for anesthesia. Operating time was one hour.

Postoperatively the patient's temperature never rose above 100.6°F.; the pulse never ex-

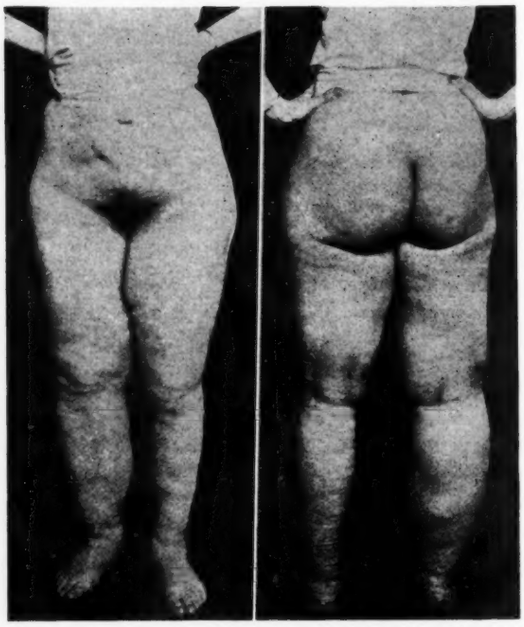

FIG. 2. Appearance immediately following Kondoleon operations on left lower extremity, August, 1927.

ceeded 100. The bandages were removed two days later. Some real edema of the entire lower limb was present, with considerable serum oozing from the lower angle of the wound.

After removal of the retention sutures nine days postoperatively the patient was allowed up in a wheel chair. The limb already appeared smaller in size.

A second similar Kondoleon operation was performed on the medial surface of the same extremity seventeen days later, August 4, 1927. Third and fourth Kondoleon operations were performed on the other extremity five months later, on January 21, 1928, and on January 30, 1928. All procedures were extensive and reached from the malleolus to just below the groin and hip region. (Fig. 2.)

The pathologic report revealed that the skin was pale and firm in consistency The subcutaneous fat consisted of coarse lobules. On section, the corium was thickened. The fascia attached to fat and connective tissue septa between the fat lobules was considerably thickened. Microscopically, the specimen presented an extensive hyperplasia of connective tissue both beneath the epithelium and in the area of the fascia. The connective tissue contained few cells and consisted of thick fascicles of collagenous fibers. There was slight mononuclear and plasma cell infiltration in the areas of sudoriparous glands and of small blood vessels. The pathologic diagnosis was extensive connective tissue hyperplasia, elephantiasis.

Twenty-year Follow-up Report. This patient has been observed over a period of twenty years during which time an opportunity was afforded to examine her several times each year.

Following her last operation in 1928 she returned to her usual work of operating a press which made paper fasteners. This necessitated controlling the machine with her feet but she had no difficulty maintaining her job. She states that her feet were not much more swollen at the end of the day and she was able to conduct her life as any other individual.

This marked relief from her elephantiasis continued for fifteen years. No attacks of inflammation and erythema occurred; she was free of any discomfort or incapacitation. Her legs were bandaged for support most of the time. However, during the past five years she has been troubled by occasional mild attacks of erythema. These always occurred on the right leg and were relieved by treatment with ice bags and relatively small doses of sulfonamide drugs. In 1945 she suffered two attacks of inflammation every three months, each attack lasting one week. Her description of these attacks is as follows: (1) a red area is noticed on the right leg; (2) a red streak follows along the line of a scar; (3) chills and fever accompany the attack forcing the patient to take to bed; (4) considerable redness of the entire leg is observed; (5) nausea and vomiting are usually present; (6) fever sores are numerous about the nares and mouth. For the past eight years generalized chronic arthritis has caused her considerable discomfort. The upper extremities, particularly, have been affected, her fingers showing marked deformity from osteoarthritic changes.

The patient was seen on August 11, 1947, seeking relief for an attack which had lasted many weeks. In an attempt to suppress her attacks, she was hospitalized. Examination revealed considerable redness and swelling of the right leg. The tissues were firm and hard; there was considerable local temperature elevation. The right inguinal glands were swollen and tender. In spite of the acute local inflammatory manifestations her temperature was 99.8°F. Examination showed leukocytes, 5,900 per cu. mm. with 62 per cent polymorphonuclears; red blood cells, 4,010,000 per cu. mm.; and hemo-

globin, 13.6 Gm. The patient did not appear very ill but complained that for almost three months on and off her right leg has troubled her.

Penicillin, 100,000 units, was administered every three hours night and day. Within forty-eight hours a sudden marked improvement took place and the leg was completely free of any redness. For the first time in months the patient was comfortable and free from pain.

With the disappearance of the local condition the inguinal nodes were no longer enlarged and tender and the patient was able to walk about in comfort. Nevertheless, a moderate amount of edema of her right leg persisted until her discharge from the hospital nine days after admission.

Unfortunately the immediate postoperative measurements are not available but from the photographs taken before operation and those taken in September, 1947, very little change in size can be noted in the twenty-year interval. A slight generalized increase in the size of both extremities has been noticed only in the past five years during which time the patient has gained 30 pounds (a gain from 135 to 165 pounds). Upon examination this increase of weight seems evenly distributed throughout her body and therefore also involves the lower extremities. (Fig. 3.)

MEASUREMENTS

Before Operation (July, 1927)	Region of Measurement	20 Years After Operation (August, 1947)
55.9 cm.....	Left calf	41.9 cm.
52.1 cm.....	Right calf	40.1 cm.
76.2 cm.....	Left knee	39.7 cm.
71.1 cm.....	Right knee	39.7 cm.

During the five months since her discharge from the hospital the patient stated that she felt better than she had been in several years. Her legs did not swell at night in spite of her not wearing bandages. In addition, she returned to work and was able to indulge in her usual manner of living as she had up until her attacks of inflammation several years ago.

FIG. 3. Condition of lower extremities twenty years later showing very little anatomic change.

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EXTRAPERITONEAL PERFORATION OF THE RECTUM*

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IN perforations or suspected perforations of the extraperitoneal rectum early diagnosis is essential. A careful digital and proctoscopic examination must be done to determine the presence and extent of perforation; then immediate, aggressive surgery is indicated. This surgery should consist of repair of the perforation if it is more than a small puncture and creation of perianal drainage of the contaminated area. The wound should be adequately saucerized to allow it to heal by granulation. If the perforation is extensive, a temporary colostomy should be performed. Supportive and chemotherapy should be used according to the needs of the individual patient and postoperative care of the perineal wound should be the same as care of the operative wound in a case of fistula and abscess. The technic and extent of surgery varies with the individual case and is based on an understanding of the anatomy (Fig. 1) and pathology of the perirectal spaces.

* * * *

CASE REPORT

O. H., a sixty-four year old white male, was seen by his private physician because of rectal pain. Digital examination revealed a splinter of wood about the length of a match stick low in the rectal ampulla. This was removed. The pain became progressively worse and on January 31, 1947, he was hospitalized complaining of severe pain in the bladder, rectum and prostate. He was unable to void except under great strain and had severe pain when he tried to void.

Physical examination was negative except for the rectum where a large area of induration was noted. The prostate and vesicles could not be felt because of the induration and edema around the lower rectum. Urethroscopy was performed and urethral stricture, benign prostatic hypertrophy and multiple false passages were noted. An indwelling catheter was inserted. Laboratory studies at this time revealed a white count of 14,000 with 80 per cent polymorphonuclears and non-protein nitrogen, 60.

During the next few days the patient became progressively worse. A paralytic ileus developed and he became febrile and stuporous.

I first saw this patient on February 2, 1947. He appeared acutely and gravely ill and was stuporous. His temperature was 102°F., pulse 110 and respirations 40. The abdomen was markedly distended and silent. Duodenal suction was being maintained. Both buttocks were indurated and seemed to have an extensive cellulitis and abscess formation. There was a necrotic area on the right buttock 1½ inches from the posterior anal commissure and an anterior anal ulcer diagonally across from this. Adequate rectal examination was impossible because of the associated pain. Immediate surgical drainage was instituted under 50 mg. of procaine spinal anesthesia.

The operative findings (Fig. 2) revealed an area of cellulitis 6 inches in diameter encircling the anus. Deep to this were multiple large abcesses involving all the perirectal spaces. On the left side the abcess extended along the left posterior wall of the rectum into the retroperitoneal space and upward for at least 12 inches. On the right side there was an abscess cavity that admitted the entire hand and which extended into the retrorectal space and upward for about 10 inches. There was a communicating tract about 1½ inches in diameter between the two abcesses passing behind the rectum about 1 inch above the anorectal line. There was a slough of the posterior wall of the rectum communicating with this tract. The pus had the characteristic odor and appearance of a colon bacillus infection but the tissues lining the abcess wall had a dark, greenish-black appearance and contained gas. Cultures taken at this time were negative for specific pathogens.

The operative procedure consisted of a longi-

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tudinal incision on each side of and parallel to the anus. The communicating abcesses were easily broken into by blunt dissection through their necrotic walls. The wound edges were saucerized to promote adequate drainage and four catheters to be used for subsequent irrigations were inserted to the depth of the wound and fixed to the skin edge. The wound was then packed with large vaginal packing. At least 1 pint of pus was evacuated during the operation.

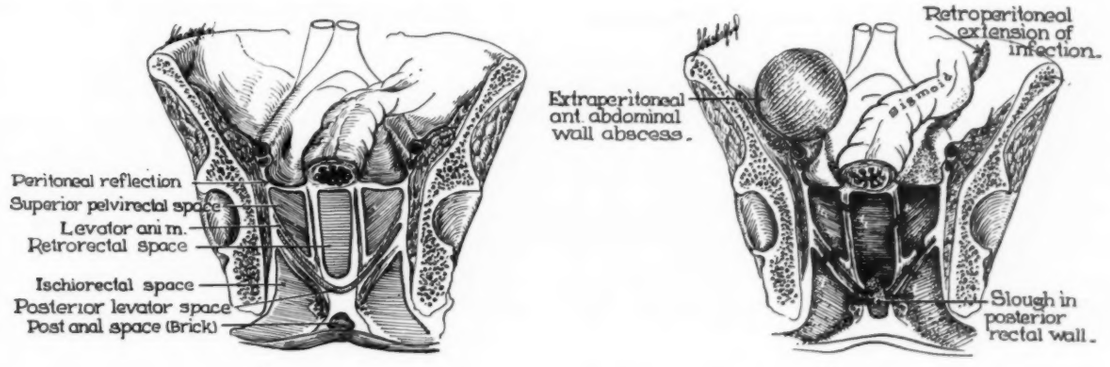

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FIG. 1. Schematic coronal section of pelvis showing location of the anatomic spaces about the rectum.
FIG. 2. Schematic coronal section of pelvis showing extent of infectious process in the case reported; shaded area represents location of pus. Note (1) slough in posterior rectal wall; (2) abscess formation in all anatomic spaces; (3) fistulous communication between spaces; (4) extension of infection to right anterior abdominal wall and (5) extension of infection retroperitoneally.

The postoperative regimen consisted of streptomycin, oxygen, tetanus and gas antitoxin, transfusion, Wangensteen suction, intravenous fluids and morphine. Special nurses were used. The rectal wounds were irrigated through the catheters with a tyrothricin solution. The patient remained critically ill for the next two days but the ileus and stupor gradually subsided.

On the second postoperative day the packing was removed; prostigmine was given. By the next day the ileus had gone. Oral alimentation with amino acids was then started. Vitamins and sulfathaladine were given by mouth. The patient's improvement was gradual; he was semi-ambulatory by February 6, 1947. The catheters had been removed from the wounds and drainage from the depth of the wounds was maintained by inserting a uterine dressing forceps into the wound to its hilt and spreading it. Several ounces of pus were released each time. The wound edges were now clean and granulating.

During this time in spite of his general improvement he continued to run a septic temperature curve and a white count which fluctuated between 13,000 and 18,000 with from 87 to 93 per cent polymorphonuclears. He complained of pain in the right lower quadrant of the abdomen; this pain was progressive. A mass slowly developed there. Each time the rectal wound was spread with the uterine forceps and pus released the abdominal mass decreased in size.

On the seventeenth postoperative day cardiac failure developed but this was rapidly brought under control. The abdominal mass had increased in size and drainage from below had ceased. On February 22, 1947, the patient was returned to the operating room and under spinal anesthesia a transverse incision was made over the mass. It turned out to be a large extraperitoneal abcess lying beneath the anterior abdominal wall. This abcess communicated with the pelvirectal area by a fistulous tract running inferiorly and posteriorly along the right side of the bladder.

Following surgery the infection rapidly subsided and the temperature and white count became normal. After adequate trial the patient was still unable to void because of prostatic obstruction so on March 14, 1947, a transurethral resection was done by the consulting urologist. On March 22, 1947, after a total of fifty hospital days the patient was discharged as convalescent.

His convalescence was gradual. The rectal wound healed except for a persistent fistulous tract with its internal opening well above the

levator in the posterior midline and the external opening in the scar on the left buttock.

COMMENTS

This case well illustrates the potential seriousness of a simple, non-traumatic perforation of the rectum. The extensive spread of the infection, the urologic complications and the profound sepsis are the result of late treatment. They represent the potential danger in any case of rectal perforation not diagnosed and treated early and illustrate the need of aggressive surgery before complications set in.

Colostomy was not done in this case because of the critical condition of the patient and because of the maximum infection already present in the perirectal tissues. Although adequate surgical drainage and saucerization of the wound was accomplished, a large slough was already present in the posterior rectal wall and a persistent fistula could not be prevented.

Earlier diagnosis in this case would have prevented most of these complications and would have saved the patient several thousand dollars in hospital bills and several months of total disability.

SUMMARY

1. Early diagnosis and treatment are essential to proper management of extraperitoneal rectal perforations.

2. A case is presented which illustrates the seriousness of late treatment in this type of injury as well as most of the possible complications and sequellae.

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Case Reports

RESECTABLE CARCINOMA OF THE CARDIA OF THE STOMACH WITH SYMPTOMS OF THREE YEARS' DURATION*

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WE are presenting this case of carcinoma of the cardia of the stomach in order to emphasize the fact that although the gastric symptoms may be present for a period of three years, the lesion may well be resectable. The experiences of others more than confirm this viewpoint. Boyce[1] and Saypol and Hinton[2] have reported resectable lesions in patients with symptoms of over five years' duration in which the size of the lesion together with other factors made it very likely that the neoplastic disease was in fact present and accounted for the symptoms throughout the long history. To be sure, cases with symptoms of this duration are infrequent (18 per cent).[3] We can expect that the duration of symptoms in patients with carcinoma of the stomach will usually average closer to six months.[4]

CASE REPORT

G. P., a fifty-one year old white male, was admitted to the Batavia Veterans Hospital on April 3, 1947, complaining of difficulty in swallowing, weakness and loss of weight. For three years he had experienced vague, unpleasant sensations in his upper abdomen which he ascribed to stomach ulcers. He treated his symptoms with various antacid preparations without definite improvement. A very small amount of apparently diluted phenol was swallowed because of ill advised lay information in a fruitless effort to cure his disease. After a year of illness characterized by progressive dysphagia and weight loss a gastrostomy was performed at another hospital where his condition was thought to be inoperable. The patient gained some weight during the following year. Subjectively, he felt vastly improved. During the next two years he gradually developed progressive weakness, increased dysphagia and weight loss. He was a bed patient for seven weeks prior to admission. He required opiates for the relief of epigastric pain. The patient had always been able to swallow thin liquids. He occasionally regurgitated food placed in his stomach via his gastrostomy tube.

The past history revealed that he was treated for syphilis in his youth and again for a two-year period in later life after a diagnosis of meningovascular lues had been made. In 1934 he had a right inguinal herniorrhaphy and a submucous resection of his nasal septum. Several months following the nasal surgery a septal perforation was noted. An emergency appendectomy was performed in 1939. The family history was not significant.

The patient's temperature was 97.8°F., pulse 82, blood pressure 120/80 and respirations 24. His weight on admission was 90 pounds. The patient was an emaciated white male who appeared chronically ill. There was pallor of his mucous membranes. The lateral margins of the tongue had numerous transverse fissures and furrows. There was a perforation of the anteroinferior portion of the nasal septum. The significant findings were confined principally to the abdomen which was scaphoid. A large, soft, gum rubber de Pezzer catheter extended from the middle of a healed upper left rectus scar. There was some slight tenderness at the

* From the Department of Surgery, University of Buffalo School of Medicine, and the Surgical Service, Veterans Hospital, Batavia, N. Y. Published with permission of the Chief Medical Director, Department of Medicine and Surgery Veterans Administration, who assumes no responsibility for the opinions expressed or conclusions drawn by the authors.

costoxyphoid angle. There was no lymphadenopathy. The rectal examination was negative. There was no evidence of ascites, enlarged liver, abdominal masses or supraclavicular nodes.

The laboratory findings on admission were as follows: red blood cells, 2,490,000; hemoglobin, 4.1 Gm.; hematocrit, 18 per cent mean; corpuscular volume, 72; sedimentation rate, 30 mm. per hour; white blood cells, 6,200, (60 per cent neutrophils and 40 per cent lymphocytes); icteric index, 9; albumin-globulin ratio 4.0/2.5; urea nitrogen, 10.2 mg. per cent and blood chlorides, 578 mg. per cent. The Wassermann and Kahn tests were negative on two occasions; urinalysis was negative. Gastric analysis on material aspirated through the gastrostomy tube showed total hydrochloric acid 50 degrees although no free hydrochloric acid was present. Analysis of the spinal fluid showed no abnormalities of the constituents or of the serologic reactions. A roentgenogram of the chest was negative. Thin barium studies of the esophagus showed a smoothly outlined narrowing of the lowest 1½ inches of the esophagus above the diaphragm. The barium passed into the stomach through a narrow, smooth channel. Retrograde barium studies of the cardia of the stomach through the gastrostomy opening showed a thickened polypoid outline of the cardia. No evidence of lesions in the pyloric or duodenal portions of the upper digestive tract was noted.

After proper preparation with forced feedings (via gastrostomy tube) of high caloric content with the addition of vitamins and blood, glucose and amigen infusions, a thoracico-abdominal subtotal esophagectomy and subtotal gastrectomy were performed with intrathoracic esophagogastrostomy on April 30, 1947.

A large lesion 6 by 7 cm. in size and scirrhus in consistency occupied the upper portion of the stomach and the lower 1½ inches of the esophagus extending through the diaphragmatic hiatus into the lower mediastinum. It was adherent to the tail of the pancreas and to the mediastinal pleura of the right chest. It extended posteriorly down to but not invading the aorta. There were no nodes in the pelvis or along the pancreatic border. The liver was free of all metastases as far as one could determine by palpation and inspection. There was no free fluid in the abdomen.

The portion of the pancreas which was adherent was amputated with the mass. A cuff of diaphragm (about the hiatus) was left on the tumor mass. When the dissection had been carried up into the chest, it was found that the mediastinal pleura in the right chest was firmly adherent to the tumor and required opening of the right chest. The mass was finally removed after the esophagus had been transected at the lower border of the ninth dorsal vertebra. The esophagus was sutured to the upper border of the stomach. The stomach was sutured to the mediastinal pleura to relieve tension partially. The remaining diaphragm was sutured about the stomach to support it partially, closing off the thoracic cavity from the abdominal cavity. Both thoracic cavities were aspirated at the conclusion of the operation. A tube was left in the left thorax, however, where most of the drainage was expected to collect. The patient left the operating room in fairly good condition; 6 pints of blood had been utilized during the operative procedure.

During the immediate postoperative period the chest was aspirated as indicated, utilizing the x-ray as a guide. After the eighth postoperative day aspirations were no longer needed. After each aspiration penicillin was instilled into the pleural cavity. Penicillin, sodium sulfadiazine, vitamin C, vitamin B complex, amigen, glucose, saline, blood and plasma were given to the patient as needed. Frequent sips of water were given on the second day. The diet was gradually increased so that puréed foods were being taken on the eleventh day at which time the temperature, pulse and respiratory curves were normal.

On the thirteenth day the patient's temperature rose to 102°F. Barium was given by mouth and x-rays were taken. A diagnosis of a leaking suture line with a thoracic abscess was made. On the fifteenth day a thoracotomy was performed to drain the abscess. A Senn type of gastrostomy was also accomplished in order to have a means of maintaining the patient's nutritional status. Ten days following these operative procedures the temperature, pulse and respiratory curves were normal and remained that way. The patient was completely ambulant twenty-five days after the original operation. His only discomforts were related to attacks of the now well recognized dumping syndrome.[5–7]

Roentgenologic studies made thirty-one days after the first procedure showed that the gastro-esophogeal suture line was healed. Oral

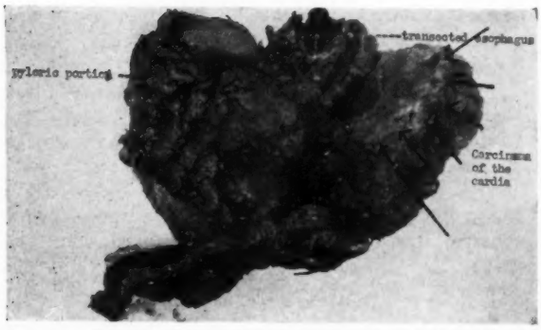

FIG. 1. Resected portion of stomach with lesion in preserved state; arrows show carcinoma of the cardia.

FIG. 2. Low power section of lesion.

feedings were then resumed. The thoracotomy wound healed slowly. The drainage tube was removed sixty days after the thoracotomy was performed. The patient was completely ambulant at this time, going to the dining room and moving about the ward at will.

The patient's weight was relatively stationary for several months after surgery. After repeated urging the patient ingested several feedings, some of which were high caloric, high protein preparations. A progressive gain in weight was evidenced. The patient was discharged on the 139th postoperative day weighing 110 pounds, 15 more than on admission. All his wounds had healed kindly. He was enjoying his frequent meals and had gained

FIG. 3. High power section of lesion.

sufficient strength to enable him to make the 100-mile journey home unaccompanied.

The pathologic report revealed that the rugae of the fundus were thickened. The lumen of the cardia was almost completely obliterated. The wall was 1 cm. thick and cartilaginous in consistency. Microscopically, the submucosa and muscularis had become invaded by acini which were regular, composed of well differentiated cells and showed numerous mitotic figures. There was a marked, proliferative fibrous reaction. These findings were consistent with a diagnosis of scirrhus adenocarcinoma of the stomach. (Fig. 1, 2 and 3.)

SUMMARY

1. We have presented a case of carcinoma of the stomach with symptoms of over three years' duration.

2. We wish to confirm and stress the fact that duration of symptoms bears no relation *per se* to resectability in carcinoma of the stomach.

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Regarding surgical therapy of angina pectoris, if the pain pathways of the heart are surgically interrupted on both sides, these patients can be considerably relieved according to Drs. White and Bland. These patients will still know if any cardiac strain is present because they can feel the painless sense of constriction, usually localized to the suprasternal notch. These sensations being probably dependent upon the vagi are not affected by the operation. The three methods that might possibly affect these painful cardiac pathways are sympathectomy (surgical or chemical), posterior rhizotomy or paravertebral block with injections of 95 per cent ethyl alcohol, often supplemented with procaine. Some 10 per cent of the patients treated with this latter method suffer recurrences, a complicating attack of acute coronary occlusion or intercostal neuralgia. Posterior rhizotomy is a long operative procedure and occasionally is followed by ischemic transverse myelitis. The authors therefore prefer sympathectomy for the average case of angina pectoris if surgical therapy is to be performed. (*Richard A. Leonardo, M.D.*)

EVAGINATION OF ILEUM THROUGH PATENT OMPHALOMESENTERIC DUCT*

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A FECAL fistula appearing at the umbilicus in an infant as a result of a patent omphalomesenteric duct is a relatively rare occurrence. Evagination of the ileum through this patent duct is of much less frequent occurrence and recovery after such an event is very unusual; hence a case report seems warranted.

Morgan[1] in 1942 reviewed the literature and reported an additional case of patent omphalomesenteric duct. He quoted a personal communication from Dr. L. B. Arey which describes the embryology: "The yolk sac of an early human embryo consists potentially of two regions. Its roof is destined to fold off as a tube which becomes the primitive gut. The remainder is the yolk-sac proper which has no nutritive function but continues to grow into a vesicle somewhat the size of a pea. It may persist through pregnancy and appear among the deciduae. The isthmus of yolk-sac tissue connecting gut with yolk-sac proper normally grows at a much slower rate and becomes drawn out into a thread-like duct, the yolk stalk. This cord is incorporated into the umbilical cord during the sixth week, but at the same time it usually is also losing connection with the gut. Rapid degeneration and disappearance is the final fate of the normal yolk stalk.

"Nevertheless in about 2% of all adults there is some evidence of the persistence of that end of yolk stalk which originally attached to the intestine. The site is about two feet above the ileo-colic valve. Such pouches are named (Meckel's) diverticulum of the ileum. Commonly they range in size from a slight elevation on the intestinal wall to a finger-like blind tube several centimeters long. Much more rarely the original stalk is retained in the entirety between ileum and umbilicus. If patent it allows intestinal contents to pass outward whence they may escape through its fistulous mouth. Such retention and patency constitute an umbilical fistula."

Morgan[1] reviewed the literature to 1942 and reported 105 cases of persistent omphalomesenteric duct. A few of these were found at autopsy in premature infants. They most often occur in otherwise normal infants and may appear as small, granulating areas at the umbilicus discharging at intervals material varying from mucoid secretions to fecal material and gas.

Kittle, Jenkins and Dragstedt[2] report three additional cases and state that this brings the total cases of patent omphalomesenteric duct to 131.

The most dangerous complication of a patent duct is that of evagination or exstrophy of ileum through this patent duct. Morgan[1] reviewed twenty-six cases; Clark[3] reported one case in 1946 and Kittle, Jenkins and Dragstedt[2] added one case in 1947, making a total of twenty-eight up to the present case report. Frequently a small bud of mucosa appears at the opening of the duct, often seen to move with peristalsis; but when a true evagination occurs, there is grave danger of gangrene and death unless prompt surgical treatment is given. This danger is the greatest argument against observation of a child with patent duct until he is older and possibly in better shape for surgery.

The fate of these twenty-eight patients with evagination of ileum through a patent duct emphasizes its dangers and the necessity for emergency operation. Of the twenty-eight patients fourteen were not operated upon; of these two cases of evagination spontaneously reduced with survi-

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val. Of the fourteen patients operated upon four survived. One of these had only a partial prolapse and not a complete eversion of ileum and another died of pneumonia and erysipelas while still in the hospital. Two others were completely cured. This report adds a case in which a patient was successfully treated surgically, with recovery.

The most recent report of successful operation was that of Kittle, Jenkins and Dragstedt.[2] This infant, a little over one month old, had a prolapse of a 15 cm. segment of ileum through the patent duct and a portion of ileum either side of the duct had to be resected and intestinal anastomosis done.

CASE REPORT

J. M. (No. 21295), a five week old boy, was delivered spontaneously at full term, apparently a normal baby. A few days later when the cord dropped off, a small fistula was noted at the umbilicus and the patient passed flatus and a small amount of feces through the opening. The baby gained weight normally and his bowels moved regularly. There were no other symptoms until about four hours before admission to the hospital at which time the parents noted a small protrusion through this umbilical opening. In a short while there were two dark, sausage-like protrusions through the opening onto the abdominal wall; apparently the baby had pain and cried a great deal.

Examination showed a well developed baby weighing 8 pounds, 9 ounces. The findings of importance were protrusion through a small (1 cm.) umbilical opening and two red, congested loops of bowel, one about 8 cm. and one 5 cm. in length. The bowel was everted with mucosa exposed very dark red in color. Urinalysis was negative and white blood cells were 16,725, with 72 per cent polymorphonuclears. The abdomen was tender.

Operation was done shortly after admission. Open drop ether anasthesia was used and the abdomen cleaned about the bowel loops and the loops covered with a sterile moist pad. The skin was prepared with merthiolate. An elliptical incision was made around the umbilicus into the peritoneal cavity. A patent fistulous tract ½ cm. long was found between the umbilicus and the distal ileum. Through this fistulous tract the proximal and distal limb of ileum had evaginated producing a v-shaped mass of everted bowel on the abdominal wall, one limb 8 cm. and the other 5 cm. long. The bowel was edematous and very congested but by gentle manipulation first one evaginated limb and then the other was milked back through the patent duct. The color of the bowel rapidly returned and appeared viable. The patent omphalomesenteric duct was divided at bowel level and the opening in the bowel was closed with an inner layer of No. 000 atraumatic catgut inverting suture and C silk outer layer, closing the opening transversely. The umbilicus and elliptical excision of skin were removed. The abdomen was closed in layers, No. 0 chromic for peritoneum and C silk for other layers.

Postoperatively the patient was given 100 cc. of blood intravenously and put on 2½ N/2 saline, 100 cc. intravenously and 100 cc. subcutaneously every six hours. Nothing was given by mouth for forty-eight hours. Levine tube was passed and suction started and used during this period. On the first day 50,000 units of penicillin were given every three hours; then the dose was cut in half. Sulfadiazine was also given in solution subcutaneously for three days. The third day postoperatively the patient was placed on a formula. Bowels moved a few hours after operation. The wound healed by primary union and the patient was discharged on the eighth day after admission. On discharge his weight was 9 pounds, 9 ounces. He has been followed up for three months since and is apparently cured.

SUMMARY

Evagination of ileum through a patent omphalomesenteric duct has been reported twenty-eight times previous to this case report. Operation has been attempted fourteen times with three survivals.

This case is one of a patent duct with evagination of ileum cured by early operation.

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PRIMARY OVARIAN PREGNANCY*

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PRIMARY ovarian pregnancy is of relatively rare occurrence. The number of cases reported in the literature is over 200; but when rigid interpretation of criteria is employed, the number falls to about eighty-five. The four postulates of Spiegelberg which must be satisfied before a diagnosis is made are: (1) The tube including the fimbria ovarica must be intact and the former clearly separated from the ovary; (2) the gestation sac definitely occupies the normal position of the ovary; (3) the sac must be connected with the uterus by the ovarian ligament and (4) unquestionable ovarian tissue must be demonstrable in the walls of the sac.[1]

The mechanism of ovarian pregnancy is possible by three modes of implantation. The oldest belief was that fertilization and implantation took place in the follicle from which the ovum was discharged (intrafollicular). It is also possible for fertilization to take place outside of the follicle and implantation to take place in the original follicle (extrafollicular). Novak believes that fertilization may take place soon after the discharge of the ovum from its follicle and then take root in the follicle or corpus luteum but that these are soon penetrated by the trophoblast which pushes into the deeper ovarian structure (juxtafollicular implantation). Curtis[2] believes that even if normal fertilization takes place in the tube, the fertilized ovum may slide back into a recently ruptured follicle and develop there. The third mode of implantation and commonest, according to Meyer, is based on the theory of the differentiating potency of the germinal epithelium of the ovary and is supported by the frequency with which endometrial tissue is found in the ovary. However, the presence of endometrial tissue in the ovary or Müllerian duct remnants on the surface of the ovary are not essential.

The possible causative factors are perioophoritis, peritoneal adhesions, an inadequate or obstructive opening in the ovary and disease of the granulosa or of the theca. The pathologic process involved is the same as in tubal pregnancy with erosion of the blood vessels, hemorrhage, enlargement of the ovary by growth and blood and, finally, rupture. The signs and symptoms are usually not differentiated from a tubal gestation but the process generally continues for a longer period of time, perhaps due to the greater distensibility of the ovary compared to the tube.[3] A recent trend of thought implies that if more careful laboratory studies were made in cases of ruptured follicle cysts or corpus luteum cysts, ovarian hematomas and cases of intra-abdominal bleeding resulting from ovarian rupture, more authentic cases of ovarian pregnancy might be found.

The pregnancy may advance to term and the fetus succumb after false labor if an operation is not performed. In addition the pain may be less since muscle cramps may be entirely absent.

CASE REPORT

L. S., a twenty-nine year old gravida II, para I, was admitted to the Beth Moses Hospital complaining of severe lower abdominal pain and a bearing-down sensation in the abdomen. The family history and past history were irrelevant. The patient had been married for five years and had one child four years old. The menstrual cycle began at fourteen years of age with periods recurring regularly every twenty-six days and lasting five to six days without any dysmenorrhea. The last regular period occurred on February 9, 1939. On February 25, 1939, she began to complain of profuse lower abdominal pain which became more severe as

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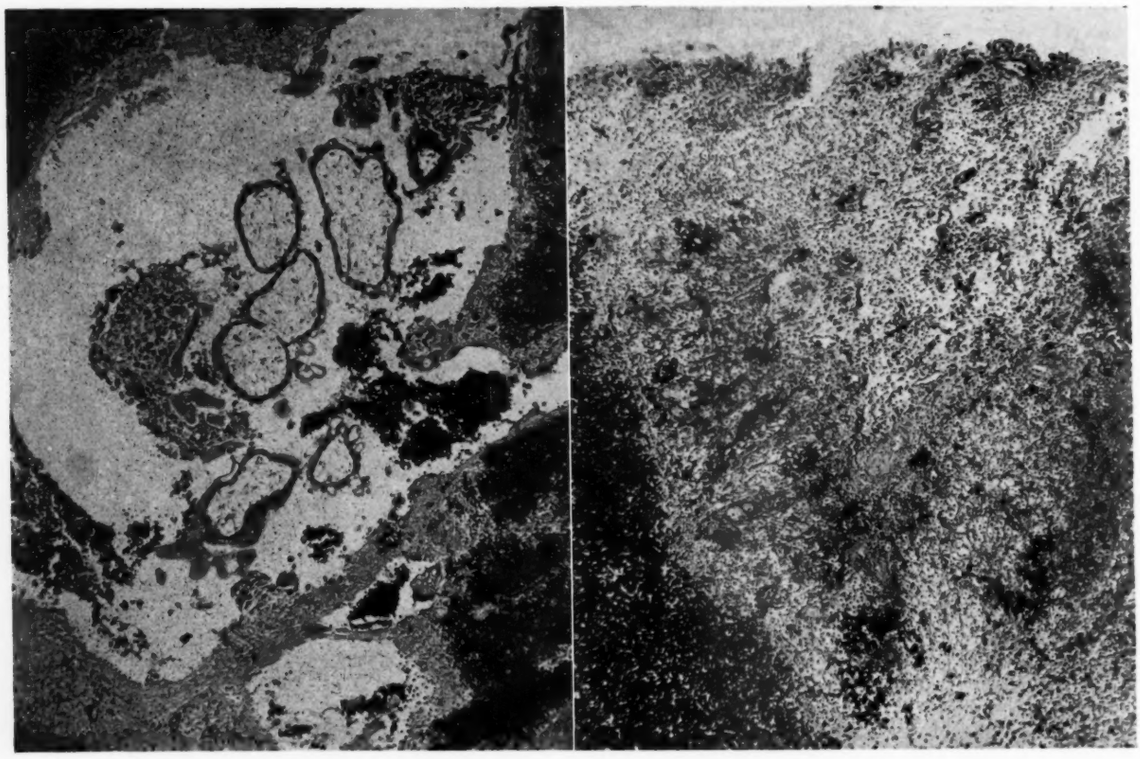

1 2

FIG. 1. Villi lined with trophoblastic ectoderm.
FIG. 2. Cavity in ovary lined with lutein cells; villi of Figure 1 found in this cavity.

it localized in the left lower quadrant. The pain was unassociated with nausea or vomiting, lasted one hour and then subsided. At 2 P.M. on February 27, 1939, the same lower abdominal pain recurred, localized again in the left lower quadrant and lasted for three hours. The pain recurred at 8 P.M. of the same day; and when the patient went to the bathroom, she fainted. At this time the pain was severe throughout the entire lower abdomen.

The patient was admitted to the hospital shortly thereafter and a general physical examination was essentially normal. The abdomen was soft throughout the upper part but there was tenderness and spasm in both lower quadrants, more marked in the left. No masses were palpable. The vaginal examination revealed no discharge or evidence of Skenitis or Bartholinitis. The introitus was parous with the cervix in the posterior position, firm in consistence and bilaterally lacerated. There was tenderness on motion from left to right but not from right to left. The uterus was anteverted, normal in size, smooth in contour, movable and not tender. The left adnexae appeared elongated, the size of a hen's egg, and tender. The right adnexae was not tender. The patient's temperature was 99.4°F., her pulse was 96 per minute and respirations 20 per minute.

The laboratory findings were hemoglobin 11.5 Gm., red blood cells 4,100,000, white blood cells 22,000 with polymorphonuclears 84 per cent and lymphocytes 16 per cent. The urine was negative and the blood pressure was 105/55. The tentative diagnosis was ruptured corpus luteum cyst with an ectopic gestation to be considered. A Friedman test was advised.

On the following day the abdomen was less tender. No vaginal bleeding was evident and the cervix was less tender on motion. The left adnexal mass remained unaltered. Twenty-four hours later the patient was still in excellent condition with the white blood cells falling to 12,000, with polymorphonuclears 78 per cent and the sedimentation rate one hour for 18 mm. On March 2nd, seventy-two hours after admission, re-examination revealed tenderness and rebound with some muscle spasm in the left lower quadrant. Vaginal examination showed no bleeding but the cervix was still tender on motion from left to right and the fullness in the left fornix was still present and associated with

marked tenderness. The posterior cul-de-sac was free. In view of the persistent findings with a reported positive Friedman test laparotomy for ectopic gestation was advised.

Under cyclopropane anesthesia the abdomen was opened by a midline subumbilical incision. About 200 cc. of free blood were found in the peritoneal cavity. The left ovary was the size of a hen's egg with a blood clot of about the same size adherent to the lower pole of the ovary where a rupture was present, with blood trickling therefrom. The left tube was normal in appearance. The right tube and ovary were normal. The uterus was the size of a four-week gestation, soft and globular in outline. A left salpingo-oophorectomy was performed and the abdomen closed in layers.

Grossly, the specimen consisted of a left tube and ovary, the latter measuring 3.5 by 2 by 1.2 cm. At its superomedial border there was a projecting hemorrhagic mass 2.8 cm. in diameter. It was intimately bound to the ovary and covered by a mass of clotted blood. Cross section revealed a completely hemorrhagic mass with a small central cavity lined with a smooth membrane. The cavity measured 0.5 cm. in diameter. Yellow areas were noted near its outer margin.

Microscopically, the tube showed no changes. Free blood, chorionic villi and decidual cells were not found. The hemorrhagic mass contained villi lined with trophoblastic ectoderm. Portions of the clot were bordered with a band of lutein cells. (Figs. 1 and 2.)

The diagnosis was ectopic ovarian gestation (left).

The postoperative course was uneventful. The wound healed by primary union and the patient was discharged on the eleventh postoperative day.

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SUCCESSFUL ANASTOMOSIS OF SEVERED BRACHIAL ARTERY*

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SHUMACKER and Lowenberg in their experimental studies in vascular repair showed that end-to-end arterial repair is attended by a fairly high incidence of complications when very small arteries are used, irrespective of the type of suture.

TABLE 1
ARTERIAL ANASTOMOSIS IN WAR WOUNDS
RESULTS OBTAINED BY VARIOUS METHODS

Method Employed	No. of Cases	Viable Extremity	Gangrene of Extremity	Gangrene (Per cent)
Non-suture tube-vein anastomosis (Blakemore)	70	29	41	58.5
Tube anastomosis	37	17	20	59.5
Ligation severed artery	2,655	1,355	1,300	48 9
Suture repair	141	87	54	38.3

With arteries of moderate size the incidence of thrombosis does not vary greatly with different methods of repair but other complications such as dehiscence, stricture and aneurysm are much less frequent when everting mattress sutures are used. The mattress technic either continuous or interrupted proved the most reliable.

Breidenbach and Lord recommend the use of Blakemore's Vitallium tubes in all cases in which tension on the anastomosis is a complicating factor. The tube may also be used as a graft when formerly ligation was practiced as the initial treatment. Some authors, however, are opposed to the use of Vitallium tubes because they do act as a foreign body. This group prefers the use of straight grafts, that is, vein graft without the Vitallium tube.

Rose performed Vitallium-tube anastomosis in eight selected patients with 100 war wounds of major arteries. Only those cases were selected in which chance of a good result was anticipated. No mention is made of the duration of the injuries or the use of anticoagulants. His results were as follows:

No.	Artery	Result
5	Femoral	Satisfactory anastomoses but only one viable extremity
1	Axillary (3rd part)	Gangrene of arm
1	Brachial (proximal to bifurcation)	Arm survived
1	Popliteal	Death from pulmonary embolism at operation

Odom in a study of the arterial injuries in the third Army showed a lower incidence of gangrene following arterial ligation than after attempts at repair. If only major arteries were considered, however, the occurrence of gangrene after ligation was 57 per cent; after repair it was 52.8 per cent. Table 1 shows the results obtained by all the various methods of arterial anastomosis in war wounds.

Popliteal injuries almost invariably result in loss of limb if arterial continuity is not restored. High ligation of the femoral artery may save the limb but usually the function is badly impaired. The individual can walk only a short distance without claudication and pain. The expectation of gangrene from ligation of large arteries as quoted by Bailey may be seen in Figure 1.

Opportunities to see lacerations of large vessels occur rarely in civilian practice. Most of the cases in the literature are those of war injuries and as a result are expected and treated in military surgery. Since these injuries are now uncommon to most of us,

* Presented before the Philadelphia Academy of Surgery on April 4, 1949.

we are presenting this case of immediate suture of a brachial artery. We believe that the use of anticoagulants and sympathetic nerve blocks postoperatively are important factors in the successful outcome of this case.

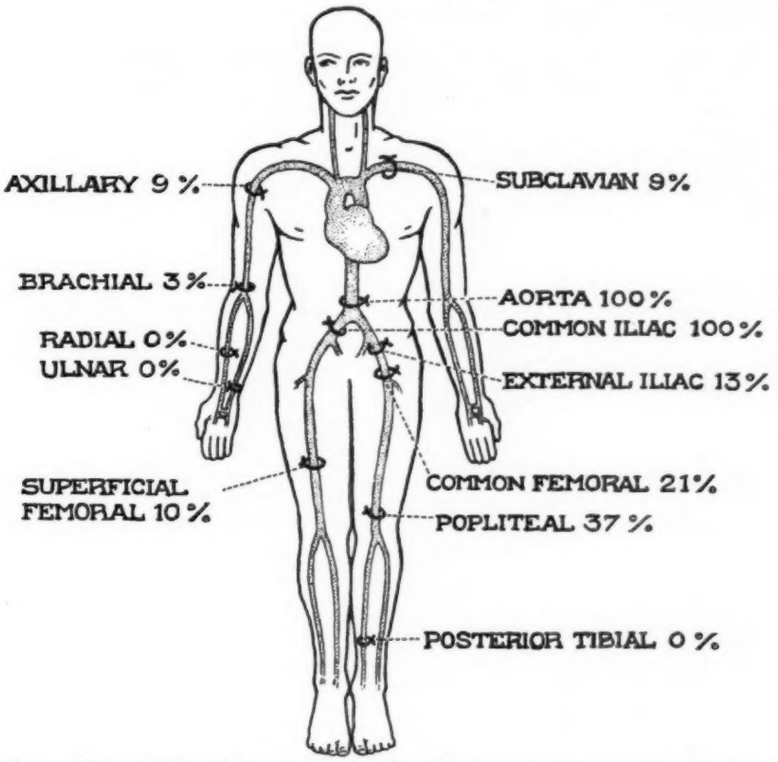

FIG. 1. Expectation of gangrene following ligation of major arteries (Bailey.[6] Courtesy of John Wright and Sons, Ltd.)

CASE REPORT

C. B., a nineteen year old negro male, was admitted to the Philadelphia General Hospital (No. 210902) just prior to midnight November 27, 1948, with a gunshot wound of the left upper arm. On admission his blood pressure was 118/68, pulse 110, respirations 26 and temperature 99.6°F. The accident had just occurred and there was no evidence of shock even though his clothes showed evidence of considerable blood loss. The point of entry of the bullet was on the medial aspect of the left upper arm. There was no point of exit. The point of entry was round, ragged and 1.5 cm. in diameter from which there was a slight ooze of blood. The left upper arm was swollen, tender and cold from the mid upper arm distally. All pulsations of the entire arm were absent. Motor and sensory function of the arm were intact but sensation of the forearm and hand was numbed. (Fig. 2.) X-ray of the arm revealed a bullet medial and posterior to the humerus and 9 cm. from the humeral head. There was no evidence of fracture. A stellate ganglion block to exclude arterial spasm produced a good Horner's syndrome but no change in the arm. Immediate operation was performed.

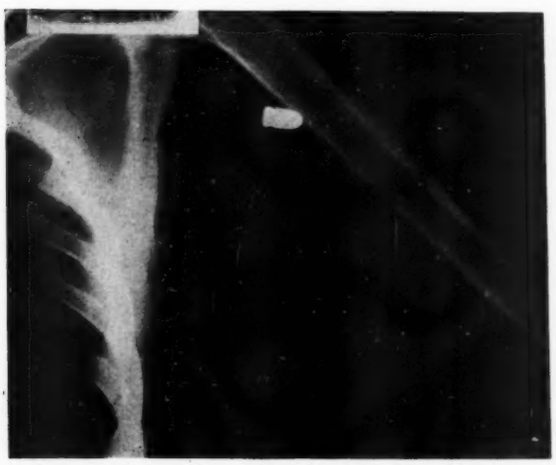

FIG. 2. X-ray of arm showing location of bullet.

The wound was explored and débridement carried out under satisfactory general anesthesia one and one-half hours after the injury.

The median and ulnar nerves were identified and found to be intact. A defect measuring 1.5 cm. in length was found in the brachial artery at the junction of the upper and middle third of the vessel. The tract of the bullet was probed and it was impossible to feel the slug. A thrombosis was found in both the proximal and distal ends of the divided brachial artery. Small rubber-shod Scudder clamps were placed on the ends of the divided vessel and the clots aspirated by means of gentle suction. The ends of the divided vessel were freshened up and cut smoothly in the transverse axis. Likewise the adventitia was trimmed from the ends of the severed artery. Both ends of the vessel were tested and found to be patent. An end-to-end anastomosis was done using interrupted No. 5-0 black silk on a small, curved eye needle. The classic Carrel technic of placing three stay sutures to triangulate the ends of the artery was used. The anastomosis was completed using interrupted everting sutures. The clamps were removed and there was a small leak at the anastomosis site requiring two more interrupted sutures. The clamps were again removed and blood was seen passing through the anastomosis. The hand became warm but a radial pulse was not palpable. It was then noted that the entire brachial artery, both proximal and distal to the anastomosis, was in severe spasm. The vessel was noted to be very tight and hard and its color a light pink or white. The wound was then bathed with 1 per cent procaine anesthesia but this did not seem to relieve the spasm. The adventitia of the vessel was further excised and this seemed to relieve the spasm somewhat; but a radial pulse was still not palpable. The anesthetist then did a stellate ganglion block following which the spasm was relieved. The vessel was seen to dilate and the pulsations became stronger. A few minutes after this the radial pulse was palpable. A piece of gelfoam was placed around the anastomosis and a rubber dam drain was placed in the bullet tract. The wound was closed without tension. The operative procedure lasted two hours and forty-five minutes. At the completion of the procedure a good radial pulse was palpable and the hand was quite warm.

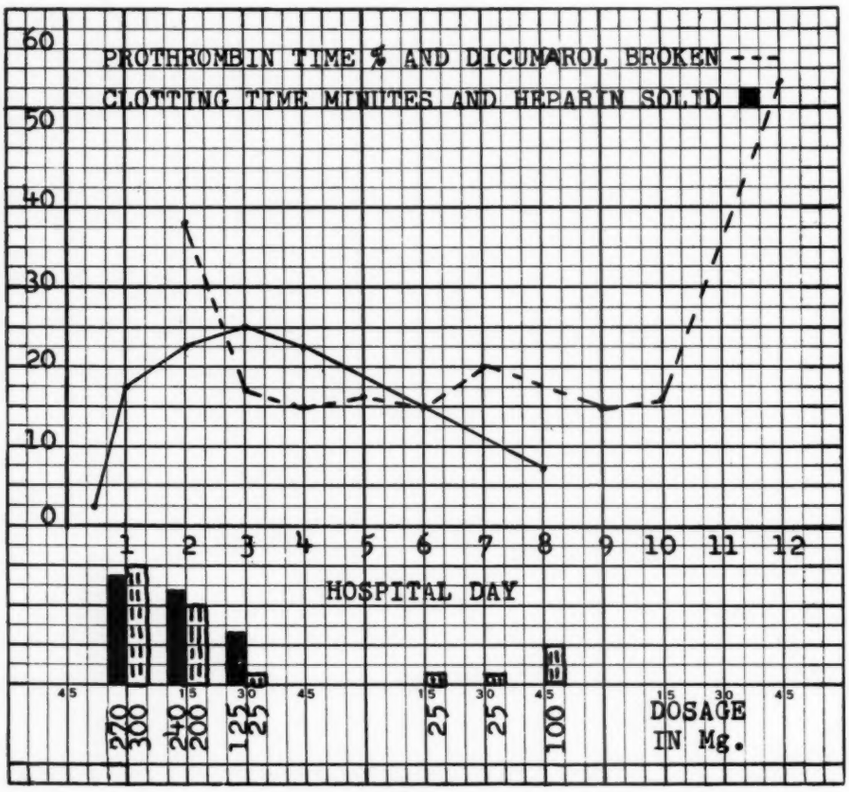

FIG. 3

Postoperatively the clotting time was found to be 2.5 minutes and the bleeding time 1.5 minutes. The following treatment was insti-

tuted: penicillin 50,000 units every three hours, toxin-antitoxin 1,500 units, papaverine 1 gr. every six hours intramuscularly, stellate blocks every twelve hours, elevation of arm, Dicumarol 300 mg. at once, heparin 50 mg. in 500 cc. saline intravenously every six hours, and anticoagulant therapy continued for eight days.

TABLE II
EFFECT OF STELLATE GANGLION BLOCK—DEGREE FAHRENHEIT

Finger	Left		Right	
	Before	After	Before	After
1	82	94	79	73
2	78	94	79	74
3	75	95	80	74
4	74	95	81	75
5	74	94	84	78
Room	76	77		

The curves of prothrombin time and clotting time maintained by heparin and dicumarol are shown in Figure 3.

The postoperative course was uneventful. The radial pulse remained good, the arm and fingers warm, there was no evidence of infection and the wound healed primarily. During his course in the hospital the patient received ten stellate ganglion blocks. (Table II.) There was some atrophy of the muscles of the left hand. The blood pressures were as follows: right arm 130/75 left arm 115/75. The patient was discharged on the thirteenth postoperative day to the physiotherapy and surgical clinics.

The patient has been seen at frequent intervals in the follow-up clinic. The muscle atrophy of the left hand is improving rapidly. He received stellate ganglion blocks for six weeks following discharge. Prior to each block the hand would be cold and the radial pulse weak but palpable. The temperature of the hand and the radial pulse would definitely increase after each block. (Table II.)

On January 27, 1949, the bullet was excised under local anesthesia from the posterior aspect of the left upper arm. The wound was closed without drainage and healed uneventfully. He has been working every day as a shipping clerk in an unheated warehouse. There has not been any evidence of claudication. The last stellate block was done on January 3, 1949. On February 12, 1949, the left hand was cold, a radial pulse was palpable and the patient said that he had had no pain in his arm or hand. Blood pressure was 110/70 in the right arm and 100/60 in the left arm.

On April 2, 1949, the left hand was warm. A radial pulse was present and of good quality. The blood pressures were the same as on the previous examination.

SUMMARY

A case of successful anastomosis of a brachial artery one and one-half hours after injury has been reported.

Suture was accomplished by everting stitches of fine silk after careful removal of clots, especially from the distal end. The prophylactic use of penicillin and anticoagulants probably played a large part in preventing infection and thrombosis. The repeated and continued use of sympathetic (stellate) blocks proved to be a definitive factor in overcoming vascular spasm and thereby in maintaining an adequate circulation to the distal arm and hand during the period of healing.

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REPAIR AND STABILIZATION OF THE FIRST CARPOMETACARPAL JOINT*

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DISABILITIES referable to the instability of this joint are not too uncommon and its adequate correction is imperative for an asymptomatic and useful thumb. The three conditions in which the authors have found the method of repair outlined herein successful are: (1) recurrent traumatic luxation or dislocation of the metacarpocarpal joint, (2) old malunited Bennett's fractures and (3) osteoarthritis with habitual luxation of the joint. An example case of each is presented.

Anatomically, the capsule of the first metacarpocarpal joint is not complete. Usually it has a considerable volar defect with no overlying structural protection which with other factors make the posterolateral part of the capsule particularly vulnerable for tears and instability. Fractures occurring within the joint also create an unstable articulation. It was therefore considered that capsular fascial repair of this vulnerable area was as important as the circular sling tendon about the joint.

The operative method used was as follows: An incision was made longitudinally across the anatomic snuffbox of the hand. (Fig. 1.) The abductor and adductor tendons of the thumb were separated. The division of the radial nerve and vessels were isolated and retracted. The capsule of the first carpometacarpal joint was exposed in a stellate manner. A small drill hole was placed transversely across the greater multangular to the base of the ridge, distal to the groove for the flexor carpi radialis and parallel across the proximal end of the first metacarpal ¼ inch from the carpometacarpal joint. A strip of fascia lata from the thigh measuring 3 by ½ inches was then pulled through the drill holes with the free ends dorsally. (Fig. 1, 1*a* and *b*.) The short end was then sutured, closing the circuit to the long end. (Fig. 1.) The remainder of the fascia lata was then spread and sutured, reconstructing a capsule for the volar half of the joint approximately ½ inch in width. (Fig. 1, 2*a* and *b*.) Reefing with interrupted mattress sutures was performed on the dorsal part of the capsule. The wound was closed in layers and an abduction cast applied to the hand with the thumb at 90 degrees. Physiotherapy (whirlpool) was usually begun the twelfth to fourteenth day following operation.

CASE REPORTS

CASE I. G. F., Jr., No. 135311, a twenty-five year old colored Coast Guardsman, was admitted July 20, 1944, with a history of frequent dislocation since March, 1944, of the first carpometacarpal articulation. At that time he dislocated the metacarpocarpal joint during a boxing match. Dislocation was reduced and immobilized at this hospital and he was referred for follow-up care to the U. S. Marine Hospital, New York. Due to the inability to maintain reduction of dislocation he was again referred to this hospital for surgery. The only significant physical finding was constant dull ache and pain on pressure of the first left carpometacarpal joint and also weakness of the thumb in adduction and flexion. Roentgenograms revealed nothing outstanding. This patient had an operative repair as previously outlined and returned to light duty August 9, 1944. Follow-up two years later showed no recurrence and an asymptomatic, fully stable functioning joint.

CASE II. F. M., No. 139909, a twenty-four year old Coast Guard gunner, was admitted October 30, 1944. He sustained a Bennett's fracture in March, 1944, and was treated with traction and immobilization at this hospital.

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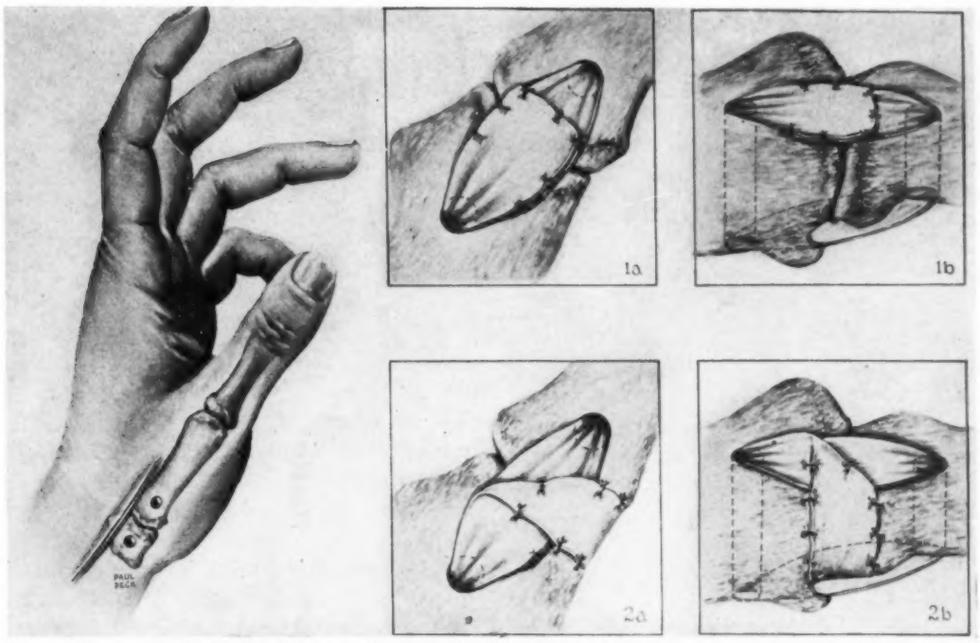

FIG. 1. Location of skin incision and drill holes; 1*a* and *b*, fascial loop sutured on itself; flap not shown; 2*a* and *b*, flap sutured for re-enforcement of dorsovolar capsule.

He returned to duty in May, 1944. However, inadvertently he was reassigned to duties as a gunner; soon after this persistent pain and repeated swelling and occasional luxation of the first carpometacarpal joint developed. On November 2, 1944, the operative procedure previously described was performed. The patient was discharged on convalescence on November 28, 1944. On his return to duty on the sixteenth postoperative day he desired and requested gunnery for which occupation a normal functioning thumb is a prerequisite. He was followed-up for two years. During that time he remained asymptomatic, was satisfied and had full function with stability of the joint and thumb.

CASE III. G. K., No. 162027, a forty-five year old able-bodied seaman was admitted February 6, 1946, with a dislocated right thumb sustained at sea October 10, 1945. The thumb was finally reduced on November 8, 1945, and placed in a cast for nine days. He was treated at the U. S. Marine Hospital, New York. Throughout he continued to have a painful, swollen first carpometacarpal joint and was unable to return to duty. Roentgenograms taken February 11, 1946, showed considerable osteoarthritis of joints of hands, with thickening and irregularity prominent in the joint in question believed by the roentgenologist to be the result of an old injury. There was also some thickening of the shaft of the first metacarpal. Physically, the joint was painful on pressure and some fusiform swelling was present, yet the capsule appeared moderately relaxed in passive movements. In view of the history and unimprovement with conservative therapy the described operative procedure was carried out February 19, 1946. He was discharged to convalescent care March 1, 1946. On May 9, 1946, he was considered fit for duty as an able-bodied seaman, with a good, functioning thumb. He has continued to work since and was last heard of in April, 1947, when he applied to the hospital for a check-up examination relative to arthritic processes in other joints.

SUMMARY

A method which has given successful results has been described for the repair and stabilization of the first carpometacarpal joint in three classes of joint manifestations.

New Instrument

A NEW PROSTHESIS FOR PROLAPSE OF THE RECTUM

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OCCASIONALLY a lesion is encountered for which surgery would ordinarily be indicated but the patient's general condition is such as to render the procedure too hazardous. On such occasions some other means of relieving the patient is highly desirable. A seventy-two year old woman with a severe rectal prolapse but in extremely precarious general condition presented such a problem. Her discomfort from the local lesion was so great that some means of relieving it was required yet surgery was interdicted by her general status. The prosthesis which is the subject of this report was accordingly devised and has satisfactorily effected symptomatic relief.

CASE HISTORY

Mrs. B. S., aged seventy-two, was first seen on January 2, 1947. She gave a history of having been operated upon for a rectal cyst three years previously. Subsequent to that time her rectum gradually began to protrude through the anal orifice. The projecting segment increased progressively in size until it reached a length of about 6 inches. Although always reducible, reduction had been more difficult of late while the ease with which prolapse occurred increased so that descent took place almost immediately on standing; even when recumbent in bed ordinary movement not infrequently was sufficient to cause the lesion to come down. For the ten months before the patient was first seen the prolapsed bowel had been out practically all of the time and had become swollen, excoriated and painful. Considerable discharge was secreted from its surface and there was frequent bleeding. Her underclothes were always stained. There was difficulty both in bowel movement and in urination and occasionally incontinence of both urine and feces occurred.

The additional history of significance was related to "strokes" three years before and eight months before. The first stroke was mild and the second moderately severe. The patient was left with considerable residual weakness, loss of sensation of the right side of the body and a practically constant tremor of the hands. While ambulatory she was very weak and insecure. She thought that the degree of weakness had been added to by the increased amount of time the prolapse required her to spend in bed.

The patient was a slight, very aged, chronically ill appearing woman of seventy-two. Obvious Parkinsonism was present. Her gait was hesitant and unsure with much difficulty in initiating the individual steps. There was a constant, coarse, rhythmic tremor of the hands which she was unable to control even on effort although on voluntary movement it tended to become less conspicuous. Weakness and hypalgesia of the entire right side were present. The hypalgesia extended onto the face but there were no motor facial changes. The deep reflexes were hyperactive on the right side and there was a questionable right Babinski sign. The abdominal reflexes were absent but the abdomen was flaccid and pendulous, the muscles stretched and without tone. There was marked peripheral arteriosclerosis; her blood pressure was 200/120. The heart showed no abnormality except for sinus tachycardia and frequent premature ventricular contractions. The abdominal examination was negative.

Locally there was a 6 inch complete prolapse of all layers of the rectal wall, a true procidentia. The mucous membrane was injected, edematous and excoriated. A large cystorectocele was also present.

It was obvious that the patient was an unsatisfactory surgical risk even for a procedure

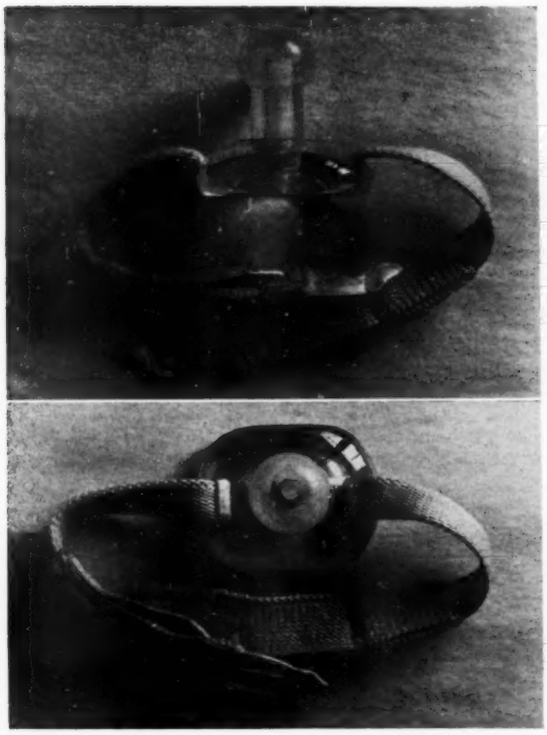

FIG. 1. Close-up of prosthesis and elastic interleg strap, side and top views.

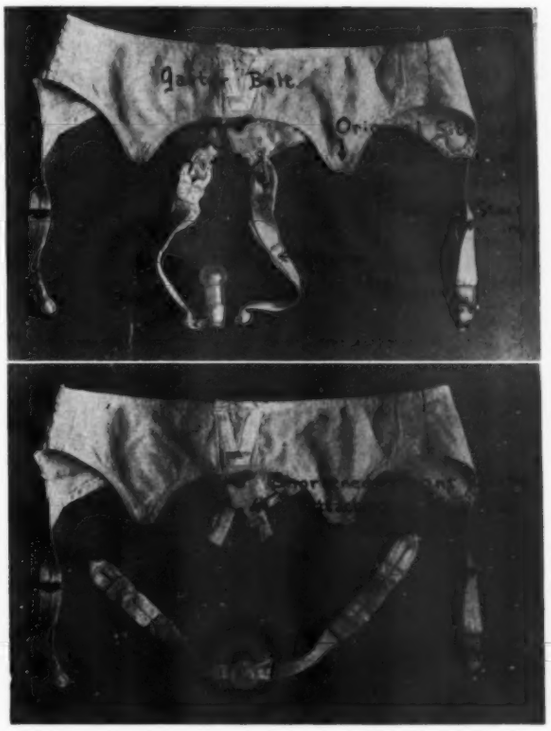

FIG. 2. Complete apparatus: interleg strap hooked onto garter belt in upper panel, detached in lower.

done entirely from below under local anesthesia. At best, even without surgery her life expectancy was very short and the important consideration was symptomatic relief rather than surgical cure. If it were somehow possible to maintain the prolapse in reduction while keeping the patient comfortable, ambulatory and free of any of the complications or sequelae of such a condition, the important objectives in this case would have been accomplished.

The prolapse could be reduced without great difficulty; but even while the patient was lying on the examining table, it began to protrude again spontaneously. In view of the marked cystorectocele it was thought that possibly if this were maintained in reduction, the prolapse also would remain reduced. A Gellhorn pessary was inserted into the vagina after reducing the rectal prolapse. On straining, however, the pessary was propelled out of the vagina with enough force to carry it about 4 feet across the room and simultaneously the rectal prolapse descended to its full extent. The prolapse was again reduced and finger pressure applied while the patient strained. It was surprising to observe how little pressure directly over the anus was required to keep the prolapse in place and the obvious thought of using some mechanical device for this purpose occurred. The Gellhorn pessary, reversed, looked as though it might serve the purpose. Accordingly the stem of the pessary was inserted into the rectum, the base remaining outside between the ischial tuberosities. Again it was found that only slight pressure on the base was required to keep the prolapse reduced and it was realized that this would therefore serve as a basis for the mechanical appliance required. It was necessary only to alter the circular base to an oval so that the sides would fit more comfortably between the tuberosities and to affix a strap to it in some way so that it could be attached to a belt about the patient's waist. With the help of her nephew, a radio mechanic, and a female relative who made garter belts, the prosthesis illustrated in Figures 1 and 2 was engineered. The base of a No. 2¼ lucite Gellhorn pessary was reshaped to an oval by tooling down its sides and at either end of the long axis transverse slots were cut. Through these slots an elastic belt with loops at each end was inserted to serve as an interleg strap. An ordinary garter belt with loop and button grip garters for the front and back of each stocking

was then taken. Both front garter straps were detached, cut short and the garter clasps then reattached to the middle of the belt in front and back. (The garters on the back of the belt were left in place for their proper use of holding up the stockings.) The stem of the pessary was then inserted into the rectum, the attached elastic strap passed upward in front and back and the loops of the strap hooked onto the corresponding clasp of the garter belt. After fixing it in place it was very pleasing to see that even maximum straining effort resulted in only slight descent of the prolapse which was drawn back into the rectum immediately after cessation of the straining effort by the elasticity of the interleg strap. Now it only remained to see if normal activity could be carried out without discomfort or irritation. This proved to be the case. After two months the only complaint was slight pressure upon the tuberosities with prolonged sitting. It was then found out that soft rubber Gellhorn pessaries were being manufactured. One of these was obtained and a new appliance was made using it. The rubber pessary came with a canal which had to be plugged but otherwise was identical. It proved, surprisingly, somewhat more difficult to tool than the plastic one. However, while it fulfilled the promise of causing less intertuberal discomfort, it produced some degree of irritation of the rectal mucous membrane. Because of this the patient found the most satisfactory procedure was to alternate the appliances, wearing the plastic one one day and the rubber one the next.

Complete relief has been obtained with the prostheses and it is thirty months that one or the other of them has been in use. The patient has been ambulatory and able to perform the minimal household tasks she is permitted. She has not only been almost entirely symptom-free during this time but the rectal mucous membrane shows no sign of irritation. Moreover the degree of descensus on straining without the pessary is now definitely less than before. Only about 3½ inches come down and this not as readily as before. Concomitantly, the patient's general condition has improved to such a degree that operation might now be considered. As yet, however, she prefers the minor nuisance of the appliance to the risk of operation.

COMMENT

By means of a prosthesis such as has been described a severe prolapse of the rectum has been maintained in satisfactory reduction for a period of thirty months with minimal discomfort to the patient and no apparent irritation of the rectal mucous membrane. The use of such an appliance was made necessary by an aged patient in so precarious a condition that operation could not be considered. Admittedly the occasion to make use of such an apparatus will not arise too frequently. However rarely the occasion may arise, it is still a great comfort to have an additional form of therapy to utilize.

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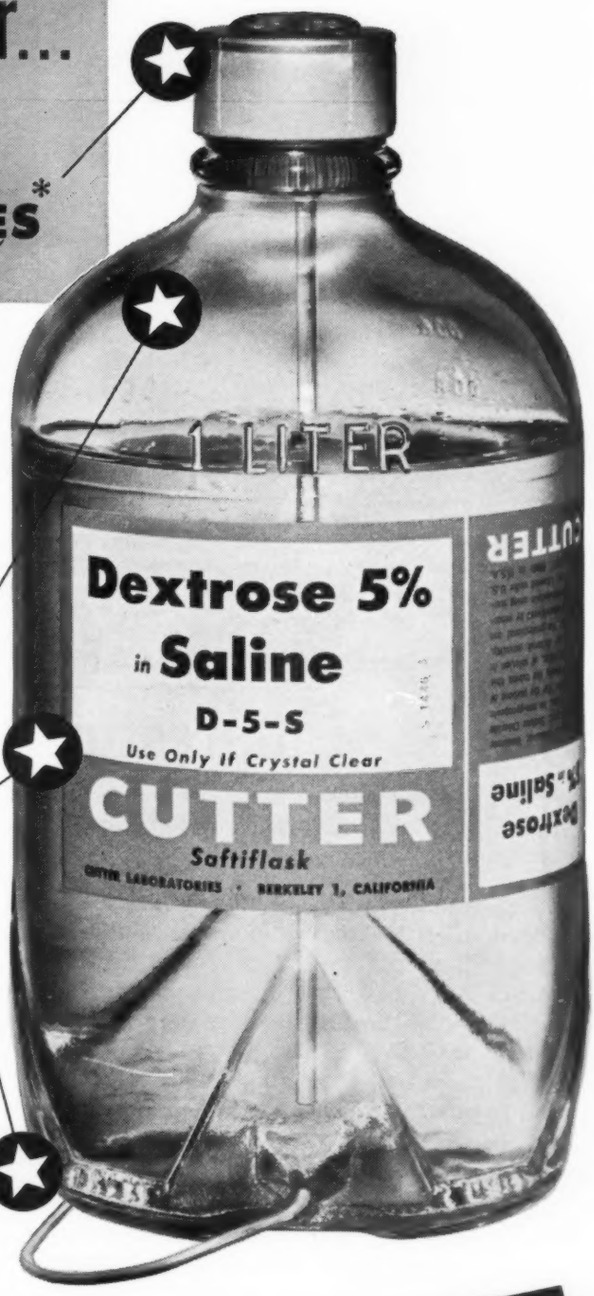

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* Pain Syndromes—Judovich, B. & Bates, W.
* Bulletin of Mayo Clinic, Sept. 15, 1948, pp. 443 and 447.
* Bibliography on request.

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Outside the Ivory Tower

(*continued from page 16*)

A NEW official monthly publication of the American Heart Association to be known as "Circulation," The Journal of the American Heart Association, will begin publication in January, 1950, according to a joint announcement by Dr. H. M. Marvin, president of the Association and Henry M. Stratton, president of Grune & Stratton, medical publishers, 381 Fourth Avenue, New York. Dr. Thomas M. McMillan, for some years Editor-in-Chief of the Journal, will continue in that capacity for "Circulation" and it is expected that the associate editors and editorial board of the older publication will also serve in the same capacities on the new magazine.

SAFER and more efficient use of anesthesia during surgical operations is promised by a simple, new, automatic device for determining the concentration of anesthetic gas in a patient's lungs, the Indiana Section of the American Chemical Society was told. Specifically, the viscosity-effusion meter, as it is called, measures the concentration of anesthetic which the patient rebreathes according to Dr. R. N. Harger, professor of biochemistry in the Indiana University School of Medicine. Modern anesthetic machines conserve the anesthetic which is exhaled and rebreathed over and over during an operation.

"The machines have flow meters for measuring the rate at which a gas leaves the tank in which it has been stored and also apparatus for regulating the introduction of liquid ether into the vaporizing chamber," Dr. Harger said, "but in the past there was no practical way of measuring the actual concentration of anesthetic vapor rebreathed by the patient."

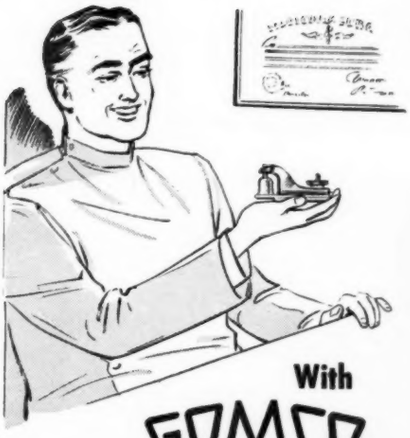
THE award of the Schering Research Fellowship in Endocrinology for 1949 to Dr. D. Laurence Wilson of Kingston, Ontario, Canada, has been announced by Mr. Francis C. Brown, President of Schering Corporation, pharmaceutical manufacturers of Bloomfield and Union, New Jersey. The award which carries with it a cash fund of $2,500 was announced at the recent annual meeting of the Society for the Study of Internal Secretions.

ONE half of the people of the world are continuously ill or become sick each year according to Surgeon General Leonard A. Scheele of the Public Health Service, Federal Security Agency. In reporting on the World Health Assembly held in Rome, June 13th to July 2nd at which he was chief of the United States' Delegation, Doctor Scheele estimated that approximately 1,000,000,000 of the world's population suffer from disease. "Much of that disease is chronic, much of it is preventable and a high percentage is curable," the Surgeon General said. "The total in human suffering, of course, is enormous. The tragic fact, moreover, is that we have the means and the scientific and medical knowledge to wipe out most of this illness."

Doctor Scheele told a press conference today that malaria afflicts more than 300,000,000 people annually; that about 65 per cent of the population of Egypt suffer from schistosomiasis, a serious debilitating illness and around 70 per cent from trachoma; that syphilis is constant among one-third of the people in certain areas of Asia, Africa and even Europe.

SOME very worth while and typographically beautiful books recently reached us for review. Although the first edition came out in 1938 and the second edition in 1941, we wish to commend the publishers (J. B. Lippincott Co.) for offering the profession the third edition of Dr. Harry E. Bacon's work, "Anus, Rectum and Sigmoid Colon." It is in two volumes and has a total of 1,127 text pages. There are 755 illustrations, many of them in color, and all of the highest order and there are ample bibliographies appended at the end of each chapter. There are also a bibliographic and subject index. This authoritative reference book on the anus, rectum and sigmoid colon has been completely rewritten and reset. Much new material of a wide range has been added, and even basic concepts have been changed due to advances in the field in recent years. Many new illustrations have been prepared by Melford Diedrick, and the drawings in color are by William McNett. We recommend this work most highly and without reservation to physicians, surgeons and proctologists with the belief that they will consider the price of this work, $30.00, well spent.

(*continued on page 40*)



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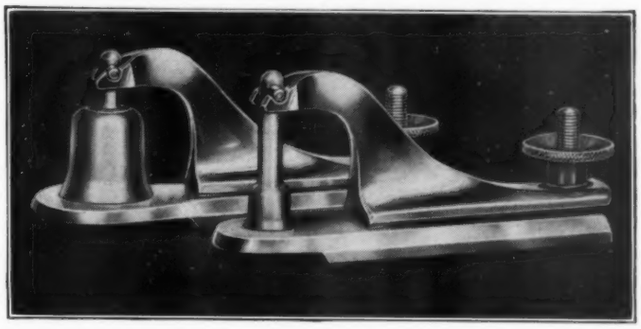

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Outside the Ivory Tower

(*continued from page* 38)

DR. C. N. Hugh Long, Dean of the Yale School of Medicine, proposed that the medical education system be revised so that doctors will not have to wait until they are twenty-eight or thirty years old before they can start their own practice. "The training of young men and women for the practice of medicine now occupies from ten to twelve years after graduation from high school," he said. "Nearly half the life of a young man or woman has passed before they can begin to be self-supporting in their profession." Dr. Long believes that this training period can be shortened without lowering the standards of medical education chiefly by permitting students to start studying medicine at an earlier age.

In the annual report of the Dean of the Yale School of Medicine Dr. Long recommends that students from liberal arts colleges be admitted to a medical school at the end of their sophomore year. The students would then complete their pre-medical training and start on their medical courses under a new, revised program. Dr. Long proposes that the program be developed jointly by the Yale School of Medicine and Yale University since the student would be taking courses both at the medical school and at the college. The new program would have a curriculum occupying a minimum of three years and the student's courses would include the following: First, general culture courses as may be indicated in individual cases; second, regular pre-medical training courses in chemistry, physics and biology and third, a revised program in medical sciences. In addition, the student during this period would be attending courses given by the departments of psychology and psychiatry to "gain knowledge of the emotional background of man." At the completion of this new program the student would then enter the final two years of the medical school program as it now exists. Under such an arrangement the student would receive his M.D. degree one year sooner than he would under the present system. Dr. Long believes that there would be additional saving in time in the case of students who are brilliant enough to enter medical school even earlier than the end of the sophomore year in college. In England, he points out, the average age of entrance to medical schools is eighteen years. Another significant advantage of the new program according to Dr. Long is that there would be a "continuous passage from college to medical school."

"Medical education has become fragmented into three distinct periods," he writes. "The first period is the pre-medical, carried out in the colleges; the second is undergraduate medicine in medical schools and the third is graduate or post-doctoral medicine taught largely by physicians in hospitals not associated with medical schools." The new program helps coordinate the first two periods and Dr. Long devotes a special section of his annual report to recommendations for greater cooperation between medical schools and hospitals that train internes.

"Last year the medical schools of this country received nearly 89,000 applications for admission from nearly 25,000 individuals," he said. "In all the schools there were only 5,864 places so nearly three-quarters of those who sought medicine as a career were turned away. In the Yale School of Medicine, over 1,500 applications were received for the sixty-five places available," Dr. Long reported. "The country needs more doctors but this deficiency is not due to any lack of material to supply them."

THERE is no record in Jonathan Swift's book that Gulliver in all his travels suffered from motion sickness. It is quite possible he did aboard the unstable sailing ships of that day and age. If he had been able to take a plane, the chances are less than one in a hundred that he would have had such discomfort. But suppose Gulliver were the rare exception and did experience motion sickness aboard a fast-moving plane. The chances are a good 75 per cent that he would be relieved of his discomfort almost immediately and 90 per cent or better that he would have no motion sickness if he took proper precautions. There is one answer for the virtual assurance of complete comfort in plane travel. That answer is the new drug, Dramamine.

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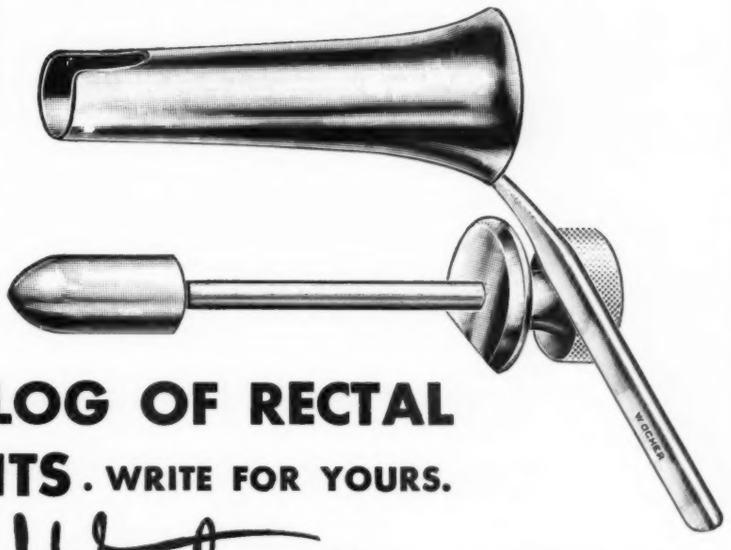

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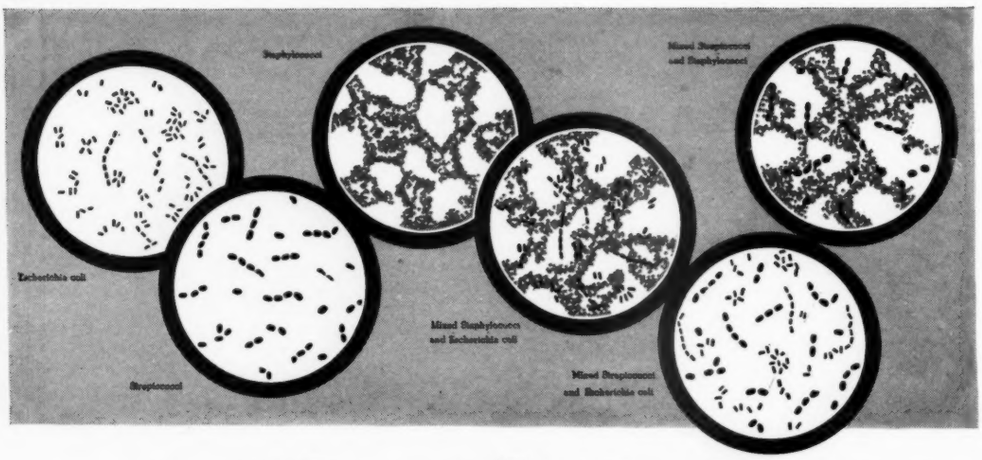

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1. Butt, A. J.: J. Florida M. A. 35: 430 (1949). **2.** Carroll, G., and Allen, H. N.: J. Urol. 55: 674 (1946). **3.** Kirwin, T. J., and Bridges, J. P.: Am. J. Surg. 52: 477 (1941). **4.** Scudi, J. V., and Duca, C. J.: J. Urol. 61: 459 (1949).

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"The condition of the baby when delivered under saddle-block anesthesia is a revelation to anyone not accustomed to its use. These babies are pink, wide awake and breathe and cry without delay."[3]

Injected intraspinally, only 2.5 mg. (1/25 gr.) of Nupercaine usually will block sensory impulses from the uterus and birth canal for 1½ to 3 hours.

Prepared in a single ampul, Heavy Nupercaine (Nupercaine 1:400 and 5% dextrose) may be injected without mixing and without dilution.
Brochure and bibliography on request.

1. Jorgenson, Graves & Savage: South. M. J., Sept. 1948
2. Schmitz, Towne & Baba: Am. J. Obst. & Gynec., 58:1, July 1949
3. Dorgan, McGaughey & Litton: Am. J. Surg., Aug. 1949

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